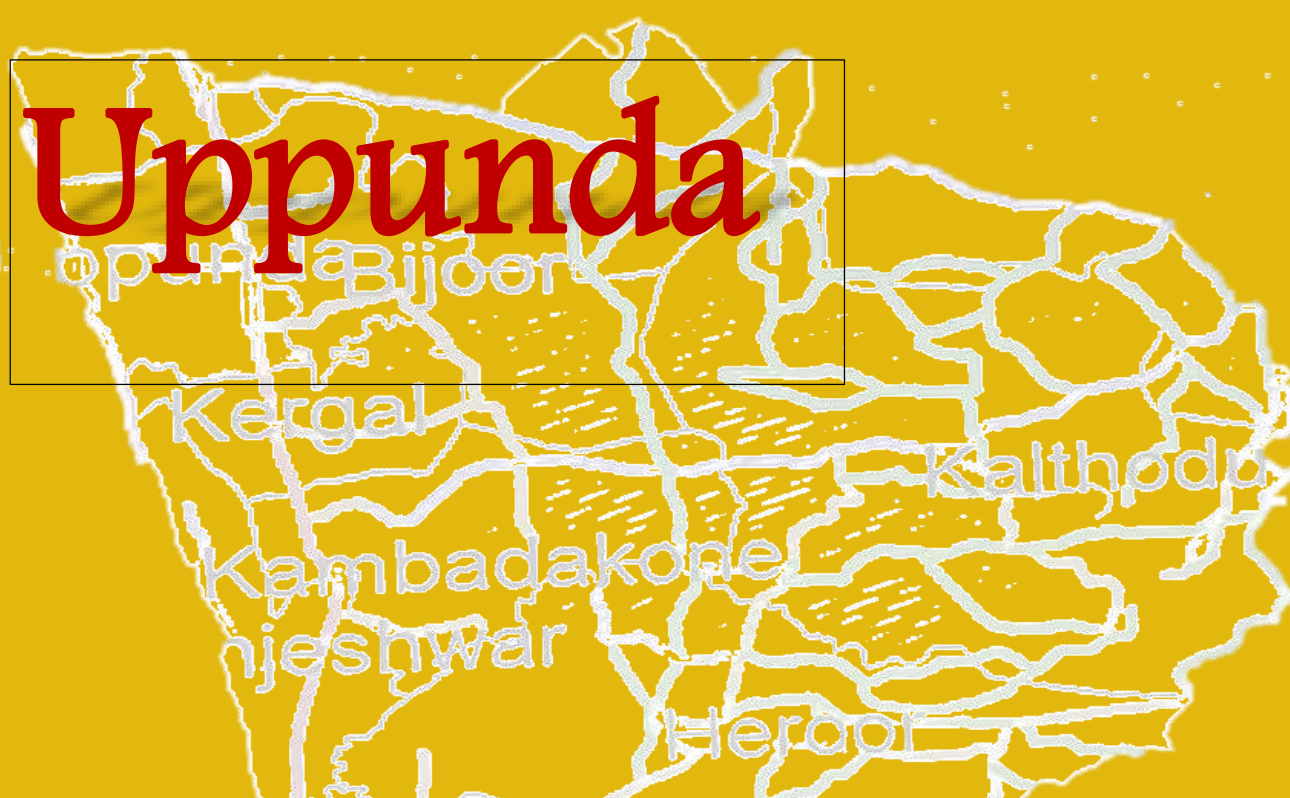




Gram Panchayat Spatial Development Plan
Dec 2020
for
Ministry of Panchayati Raj
Government of India



MANIPAL SCHOOL
OF ARCHITECTURE AND PLANNING
MANIPAL
(A constituent unit of MAHE, Manipal)

PROJECT TEAM

Manipal School of Architecture and Planning(MSAP), Udupi District, Karnataka

Overall Co-ordination:

Dr. Deepika Shetty, Director and Professor, MSAP

Project Team:

Dr. Udaya Shankara HN, Professor, Department of Civil Engineering, MIT, Manipal

Shri. Lino Yovan, Research Associate, MIT, Manipal

Ms. Joicy KJ, Associate Professor, MSAP

Shri. Shanta Pragyan Dash, Assistant Professor, MSAP

Ms. Ipsitaa Priyadarsini Das, Assistant Professor, MSAP

Shri. Amarnath Sharma, Assistant Professor, MSAP

Ms. Rituka Kapur, Assistant Professor, MSAP

Shri. Satyaprakash Das, Assistant Professor, MSAP

Ms. Sanjana Shetty, Assistant Professor, MSAP

Ms. Sasmita Chand, Assistant Professor, MSAP

Ms. Krutika Madkaiker, Assistant Professor, MSAP

Ms. Sharvani Bhat, Student Intern, MSAP

Masters students from second year Masters in urban design and development. (M.Arch. MUDD), MSAP

Aadityaraj Jain	Kotian Gaurav Srinivasa
Rahul Menon	Sidhartha Sunil Dutt
Praveen Kumar R	Harnoor Dhillon
Pooja Pankajbhai Mehta	Kanchi Madhulika R
Auna Sando	Abhijna
Tanya .M. Thimmaiah	Aayushman Singh Bhati
Gayathrie J	R P Harini
Sarvani Gundu	Pinki Bose
Akkamahadevi	Aman Kashyap
Debjani Das	

Regional Remote Sensing Centre - South / NRSC / ISRO, Bengaluru

Overall Co-ordination:

Dr. Sudha R., Scientist ‘SG’

Project Team:

Dr. K.S. Ramesh	Head, Applications
Dr. Rama Subramoniam S.	Scientist ‘SF’
Smt. Shivam Trivedi	Scientist ‘SE’
Smt. Manjula V. Bhagwat	Scientist ‘SD’

RC-North (New Delhi) Team and RC- Hyderabad Team:

Provided inputs on satellite datasets and thematic layers (SIS-DP Phase-I), household survey data and results of run-off estimation.

Overall Technical Guidance:

Dr. C. S. Jha	Outstanding Scientist & CGM, RCs, NRSC
Dr. K. Ganesha Raj	General Manager, RC-South
Dr V M Chowdary	DGM, RRSC-North, NRSC
Dr K Chandrasekar	Head, RC-Hyderabad, NRSC

ACKNOWLEDGMENT

I appreciate the trust laid by the Ministry of Panchayati Raj, Government of India (MoPR), Shri. Sunil Kumar, Secretary MoPR (In Chair), Shri. K.S Sethi, Joint Secretary, Governance Division, MoPR, for giving us the opportunity for working on this Gram Panchayat Spatial Development Proposal for Karnataka. Shri Sunil Kumar's unstinted support ensured project progress and its completion.

I would like to thank Shri Vishnu Chandra and Sri. Udaya Kumar, DDG-NIC, Dr. C.S Jha, CGM, NRSC, Shri. V.M. Chaudhury, DGM, NRSC and Shri. Vinod Sharma, NRSC and State Coordinator for Karnataka Dr. Sudha Ravindranath, NRSC who made this work possible through their guidance and invaluable support throughout all stages during the progress of the project. We could not have succeeded in the study without the relevant data and maps made available to us whole- heartedly by NRSC team.

I would wish to express our gratitude to Smt. Uma Mahadevan, IAS, Principal Secretary (Panchayat Raj), Smt. Priyanka Mary Francis, IAS, Commissioner, Panchayat Raj, Karnataka and Ms. Preeti Gehlot, IAS, CEO, Zilla Panchayat (Udupi District) for providing their valuable observation and practical suggestions on the study.

I am grateful towards Shri. G.D. Madhar, Administrator, Uppunda Gram Panchayat, Shri. Riyaz Ahmed, PDO, Smt. Girija, Secretary all members and officials of Uppunda Gram Panchayat who showed keen interest to extend their support for data collection. My sincere thanks also goes to the volunteers Shri. Narsimha, Shri. Amrut Kumar, Ms. Srinidhi, Ms. Veena, Ms. Sridevi, Ms. Srimathi, Ms. Mamata, Shri. Sandesh, Shri. Nagaraj and Shri Chikkaya who helped the team for ward wise household surveys and accompanied the team to various identified sites and ensured that all the related information was made available.

I acknowledge the support and recommendations of Shri. U Sandesh Bhat, Shri. Mohan Chandra and Shri. Praveen Chandra (Social workers Uppunda Gram panchayat) and Panchayat Officials for their active participation during the focused group discussion, Shri. Amrut Kumar, Shri. Riyaz Ahmed (PDO, Uppunda Gram panchayat) and Narsimha, (Bill Collector) Shri. Praveen Chandra and Shri. Mohan Chandra (Social workers) for their valuable inputs during the stakeholders meeting.

I also acknowledge the Student Volunteers Achinta Shetty, Akansksha Shetty, Ayush Purohit, Namrata Rao, Pramod, Sanjana Shenoy and Srma Shetty for their support for the conduct of household surveys. I am thankful to the Students of Masters in Urban Design and Development Tanya MT, Sarvani G., Gayathrie J., Aadityaraj J, Rahul M, Debjani Das, Praveen Kumar, Auna Sando, Akkamahadevi, Pooja Mehta, R P Harini, Harnoor D, K Madhulika, Aman K, Ayushman S, Gaurav K, Pinki B, Siddhartha S, Abhijna for their timely contribution towards the project.

I am grateful to Manipal Academy of Higher Education for the permission and support facilities for the project.



EXECUTIVE SUMMARY

The project was to develop model plan for spatial development Plan as conceived by Ministry of Panchayati Raj, Government of India, to be futuristic and create a way forward for the next 20-30 years. The basic goal of the project was taken as Sustainable- Balance which can last, which can be maintained over long period of time, beyond economy, GDP, Per capita income criteria, and Development – which is better, gives more opportunities, gives better facilities, beyond growth and different from bigger the better concept. The four pillars of sustainability were developed through study of the context with the following layers as the foundation. First basic foundation which cannot be changed and has to be the basis of all decisions is the 'Kestra'. This layer is developed by studying the natural setting, the geography, climate, flora, fauna, geology, hydrology etc. The second layer which needs to be respected and is essential to develop identity of the place is the 'Loka'. This layer studies the paradigm of the context which has evolved over time through historic events, beliefs, traditions and evolution of settlement pattern. The third layer which understands the dynamics of the settlement and its needs is 'Desa'. It is understood through the social and economic status of the place, the governance system, the political structure, the demographic distribution, occupational characteristics, income etc. The final layer assesses the present resources and facilities available is 'Kala'. This layer is developed through documentation of the physical infrastructure for basic services and social facilities of the settlements. Added to this the systems of operation in place for transportation, housing, education, healthcare, waste management, providing various services etc., is studied noting the efficiency and deficiencies of the same. The next stage in the project involved bench marking the goals of the future plans for the settlement looking at the aspirations of the people at the village level, the goals set at district level and state level and finally the vision of future at national level. Here the idea was to remove the gap of development between rural and urban with an idea that rural is as good a place to settle as an urban setting. The goals were to look at rural as a driver of future economic and social welfare of the country. Whenever we set the future development plan it is important that we see that the plan proposed is change for the good. We should plan for the resource management, the waste management and an enabling setting for the people of the place.

The context of Udupi District is that of a land where west side is the Arabian sea and the eastern side is the Western ghats. It has a unique geography where the altitude changes from 1000m to 0m above mean sea level across 10km making it a steep terrain. Its climate is that of hot and humid, and receives very high rainfall of around 4000mm per year. The 196km of coastline is punctuated by five rivers originating from the western ghats and having a web of tributaries and drains across the land. The settlement consists of a web of small and medium sized villages scattered all over the district in three vertical belts. The population is highest along the coast with the national highway and most of the medium sized towns are here, the midland is agricultural development with medium density and large villages and the ghats strip in the east is the low density village settlements in a predominantly forest area. The terrain and settlement go hand in hand, with the form of settlement as scattered development, and the rural and urban form merging along the roads in a gradual manner. The proposal is to create a web of such development centers which includes urban centers and gram panchayats which provide the necessary facilities to nurture and support the future of the people.

The project took one month of July collecting data from secondary sources, planning the formats of data collection and creating checklists, questionnaires and building of team for the project. The next month of August went in creating base maps, getting app from NRSC, meeting the gram panchayat members and administrators of the district and briefing the team of volunteers. The following month of September was spent in collecting the data from the villages and reviewing it with the assessment of satellite maps, documenting facilities, infrastructure with household surveys, focused group discussions etc. We also got maps from NRSC with higher accuracy for base maps. The month of Oct was spent in developing the vision plan, detailing the concept and creating the masterplan in consultation with the administrators of state, district, gram panchayats and stakeholders of the village. End of Oct and Nov there were review meetings and presentations to all stakeholders, administrators and state coordinators whose comments, observations and suggestions were incorporated in the final proposal.

- Uppunda is part of 17 important biospheres listed by the UNESCO as Tallur Biosphere. Uppunda is a high-density low risk zone with 200 dwelling per sq.km. But in CRZ area it is 498 units per sq. km. So in CRZ area scope of further construction is not there. The new construction can come on the eastern side of the G.P. As per the Norms for regulation of activities under CRZ, in CRZ-I No new construction shall be permitted. CRZ-III, Areas up to 200 meters from the HTL have to be earmarked as a 'No Development Zone'. Agriculture, horticulture, gardens, pastures, parks, play fields are permissible. Area between 200 and 500 meters of the HTL in designated areas of

CRZ-III can be developed with prior approval from the Ministry of Environment and Forests (MEF). In the case of Uppunda, ward 6,7,8,9,10 ,1 falls under CRZ. Out of which ward 7 is in low risk zone. As per the shoreline data, Uppunda area has artificial and stable coast with low accretion. Therefore, prevention of the spit growth and checking the growth rate of the spit is considered a viable means of coastal zone management under the circumstances. The area of submergence for 1 m rise in water level is up to 42.19 km² and subsequently for 2 m, 3 m, 4 m rise in water level are 56.34 km², 75.04 km², 89.58 km² respectively.

- Overlapping the ward map on flooding pattern map we analyzed that ward no. 6,7,8,9,10 along the coast and river were the most vulnerable to floods. This leads to reduction of sweet water as ocean water approaches deep inland during flood. Salination of water is a major issue in this gram panchayat and is affected by salt water as fish farming is majorly practiced here. Since Uppunda is in a coastal plain with soft underlying sediments, the rivers flowing in these areas take a curved course & keeps changing its course. It is recommended no construction along the course. 60 % of land is **Sand or sandy soil** is formed by the smallest or fine particles of weathering rocks; This doesn't suit agriculture and growing plants as they have very low nutritional value and poor water holding capacity. Rest is **loamy Soil**, a mixture of clay, sand and silt soil which consists of additional organic matter, is very fertile, it is well suited for cultivation as the plant roots get a sufficient amount of water and nutrients for their growth and development. This is already being used for agriculture of paddy and groundnut. The central area is low lying and tends to get flooded during rainy season hence maintaining these areas as agriculture and no conversion to build structures is to be allowed here.
- There is a famous Durga Parameshwari temple which is very popular and attracts visitors of more than 25,000 per day during festivals. Each section of society and cluster of houses were associated with their local gods and temples within 50m of the houses. They meet there regularly. There is a strong community bonding and local support which is good. The traditional cuisine and local rituals are followed which can be harnessed for tourists or packaged food industry. This was a potential to be used for the future development plans.
- The main issues and concerns were the lack of good healthcare facilities and education facilities for vocational and professional courses. 80-85% of the household depend on fishing and allied activities for their income which is very good. An adult male gets @RS 5000 per trip in a boat. This leads to youth around 15 years of age to discontinue studies and join the fishing activity. The women and children are very vulnerable if without male earning member. Other profession and income is very less hence well-educated youth migrate for education and employment opportunities. The waste management was dismal and there was urgent need to enforce the best practices as soon as possible to prevent further damage to the environment and health of the people. The old, disabled, women and children were vulnerable due to lack of access to facilities for education, healthcare and additional income source. There was a need to create center to support women and child welfare and support centers. There was child labor and drinking addiction in low income groups which made it necessary that the schemes were made to reach children directly rather than in form of money or through parents. There was a need to collate all data and statistics from various departments and groups to collate the existing situation accurately and see that the financial resources are given to the projects, schemes and people where it is needed in reality. There is mismanagement of funds and facilities due to duplication and false claims. On the other hand, there is neglect of people, schemes and projects due to lack of data capture. This can be avoided if there is integration of all data regarding people, projects and schemes at gram panchayat and is cross verified and referenced on ground at regular intervals.
- On overlapping the two major conflicts points can be found mainly because of settlement encroachment which may obstruct the natural water flow may create drainage issue in the future. Low bearing capacity of soil is not suitable for any heavy construction activity. The water supply for most of the houses here are provided through bore well (about 22' deep) constructed by the panchayat. Municipal water supply is seen once in every alternative day. Some of the houses also have their own wells which supports their water requirement. The porous nature of the soil helps to recharge ground water table, during rains. The coastal area on the west and the highway at the east are at higher contour level and the central area is at lower contour level. The porous nature of the soil and the saltwater intrusion makes it unsuitable for cultivation. Storm water drains are inadequate and is not properly distributed throughout the village. With respect to the depth of the bore well, the saline nature of water is found at 10' depth. During summer, the saltwater intrusion below ground level makes the water not suitable for drinking. Houses have drains leading to fields. Dumping of waste blocks the drains. Street lights in interior roads are



missing. High density of houses near the coast @400 houses per sq km. some are not with legal paper. Access roads to most of the houses are missing completely near the coast. Rest of the access roads are very narrow and badly maintained which may lead to problems during disasters as no ambulance fire truck can reach the houses of this village. 10% of the houses were very bad condition and need to be reconstructed. 30% of the houses had low plinths and may need protection from flooding during rainy season. Mobile network and internet facility is very bad. No solid waste management which leads to waste being dumped into the river and sea. Toilets need to be redone with new systems of bio digesters. The traditional septic tanks may not be recommended as due to high water table there may be water pollution.

The key points of vulnerability were identified for the coastal villages like Uppunda is as follows.

Sl no	Parameters	Index	Remarks
1.	Sea-level variations	CVI (Coastal Vulnerability Index)	Uppunda is a high density low risk zone with 200 dwelling per sq.km. But in CRZ area it is 498 units per sq. km. So in CRZ area scope of further construction is not there. The new construction can come on the eastern side of the G.P
2.	Geomorphology	CVI	It shows the relative erodibility of different types of landforms.
3.	Regional coastal slope	CVI	A slope which is higher than 0.6% is assigned low vulnerability and lower than 0.3% is assigned high vulnerability.
4.	Shoreline change rates	CVI	(needs to be found from map)
5.	Mean tide range	CVI	For the selected study area, the ranking of tidal range is such that micro tidal (tide range less than 2m) coasts are at higher risk and macro tidal (tide range more than 4m) coasts are at lower risk. The study area has a tidal range of 1.6m and therefore has high vulnerability.
6.	Mean Significant Wave Height	CVI	Maximum wave height recorded so far is 5.4 m with zero crossing periods of 8.9 seconds.
7.	Population	CVI	Population is an economic variable since people would spend to safeguard their property and homes. Population of Uppunda is 11,456 .

Based on the study and issue identified the vision for Uppunda is, **‘Developing a sustainable coastal village that assures livelihood security of the community & socio-economic development through capacity building, while preserving & managing the resources responsibly by respecting the coastal ecosystem.’**

Goal 1: Coastal protection

Objectives:

- Shoreline Protection, Reducing salinity due to salt water intrusion, Protecting the marine ecology, limiting human intervention in sensitive areas of coast and sea (fishing), following CRZ rules, controlling settlement density, Flood resilient structures, Enhancing traditional practices related to fishing & agriculture

Goal 2: Community development

Objectives:

- Creating alternative job opportunities, employment generation & trade, establishing home product industries, Preserve the cultural & traditional practices

Goal 3: Improving overall infrastructure

Objectives:

- Accessibility – road connectivity, Improving health & education facilities, Improving drinking water quality, Development of allied housing infrastructure.

Goal 4: Efficient Waste Management

Objectives:

- Value waste as a resource, Decrease consumption and increase the recycling of paper and plastic waste, Bio-degradable alternatives for packaging, Adopt an-AVOID REDUCE REUSE RECYCLE policy, Create awareness in community about segregating waste at source

The key points of resilience were identified as follows

<u>Sl no</u>	<u>Parameters</u>	<u>Remarks</u>
1.	Social	Access to and participation in various groups or organizations. Peace and security in the area.
2.	Economic	The money that allows people to adopt various livelihood strategies. This could be in form of a regular source of income or savings.
3.	Community Capital	The human, natural, built, and social capital from which a community obtains benefits and upon which the community depends for continued existence.
4.	Institutional	All the policies, acts etc. made by the official bodies which helps in vulnerability reduction of the any community.
5.	Housing/Infrastructure	The basic infrastructure which people utilize to function more productively.
6.	Environmental	The natural resources (water, forests, land) and associated services (e.g. storm protection, erosion protection) on which resource-based activities (e.g. fishing, farming, etc.) depend.
7.	Regulatory	Regulations set by the government bodies (e.g. CRZ regulations) that help in biodiversity conservation and thus enhancing peoples' livelihood.
8.	Business Plans	The business plans of private companies that have an impact on rural peoples' livelihood.
9.	Connection and Caring	Helping each other and working together for solutions.
10.	Information and Communication	Information and communication technology (for e.g. prior alert and warning) could enhance rural communities' disaster resilience.
11.	Transformative potential and disaster recovery	The ability of people to quickly return to normalcy once any disaster occurs.

The proposed masterplan and interventions were as follows.

Coastal Protection:

Improving shoreline by retaining the natural ecosystem, with soft engineering techniques; enhancing it further with native vegetation.

Road Infrastructure:

Providing an external loop system with existing roads to form a ring road to solve issues of localized flooding and accessibility.

Water Management:

To overcome the critical issues of shortage and salination with the help of preventive measures and methods and create a sustainable livelihood

Enhancing Neighborhood level development:

At the neighborhood level the opportunity for the community (Community workspace, waste management).

Housing Typologies & Design and Construction Guidelines:

To analyze existing issues regarding housing and provide appropriate design & planning

Skill development and Vocational Training Centre:

To enhance the employability among women, unemployed people

Village Market Space:

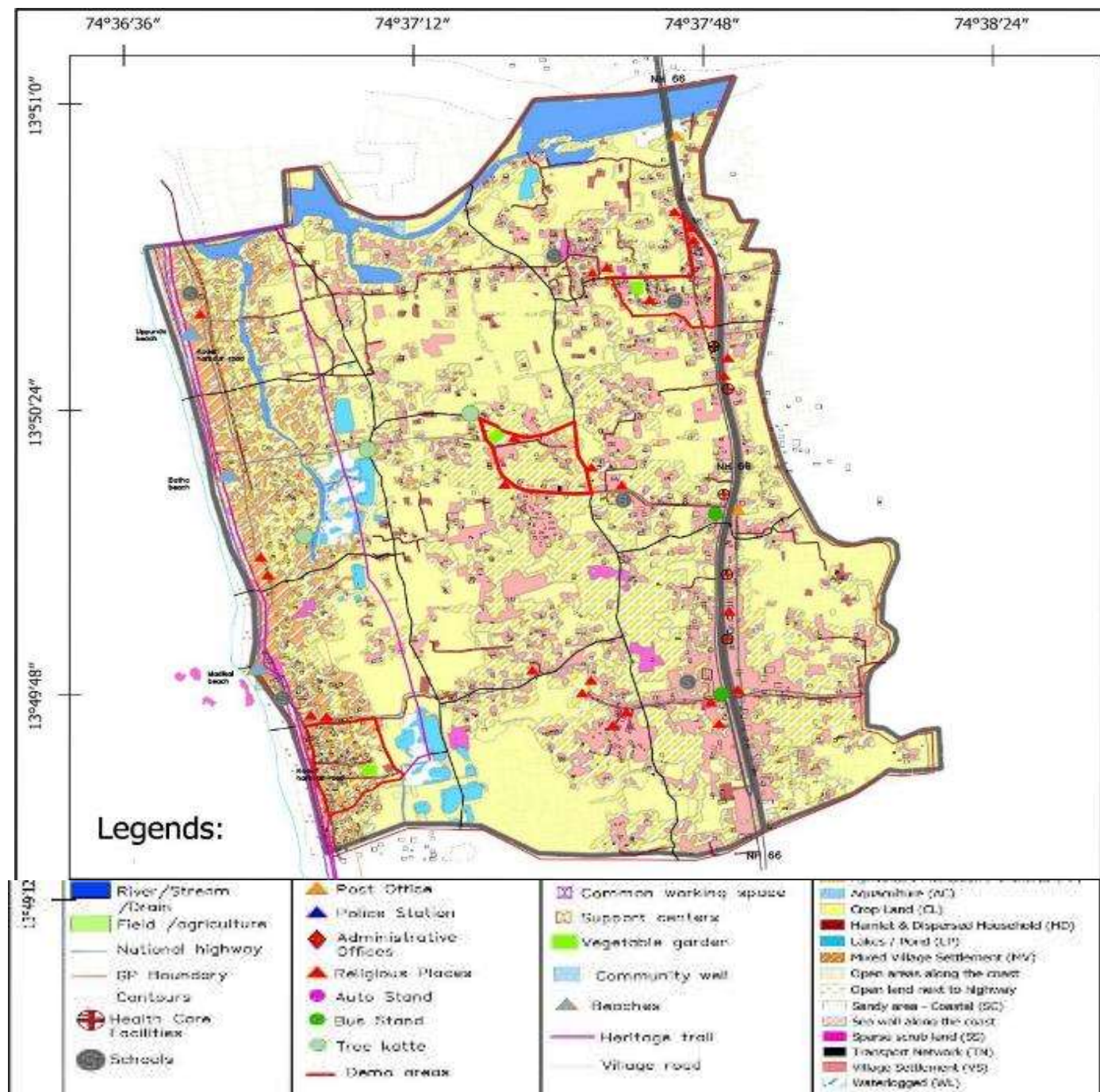
This market space helps to create and satisfy the needs of rural market

Sustainable coastal fisheries development:

Fisheries production also plays a critical role in food security and livelihood

Sustainable beach tourism:

To maintain the balance between tourism's economic advantage and environmental sustainability,



For the community along with providing basic infrastructure for waste management, skill development and better road construction following measures were introduced.

Objective

- Create sociable community space.
- Addressing food security, water issues & lack of awareness
- Protect the natural and heritage assets in the village.
- Promote sustainable way of living for the villagers.

Delineation of the rescue zones in case of disaster and double up as support centres during fair weather.

- near the coastal area (Ward 7)
- near to the National highway 66 (Ward 2)
- Centre of the village (Ward 4)

Community Wells

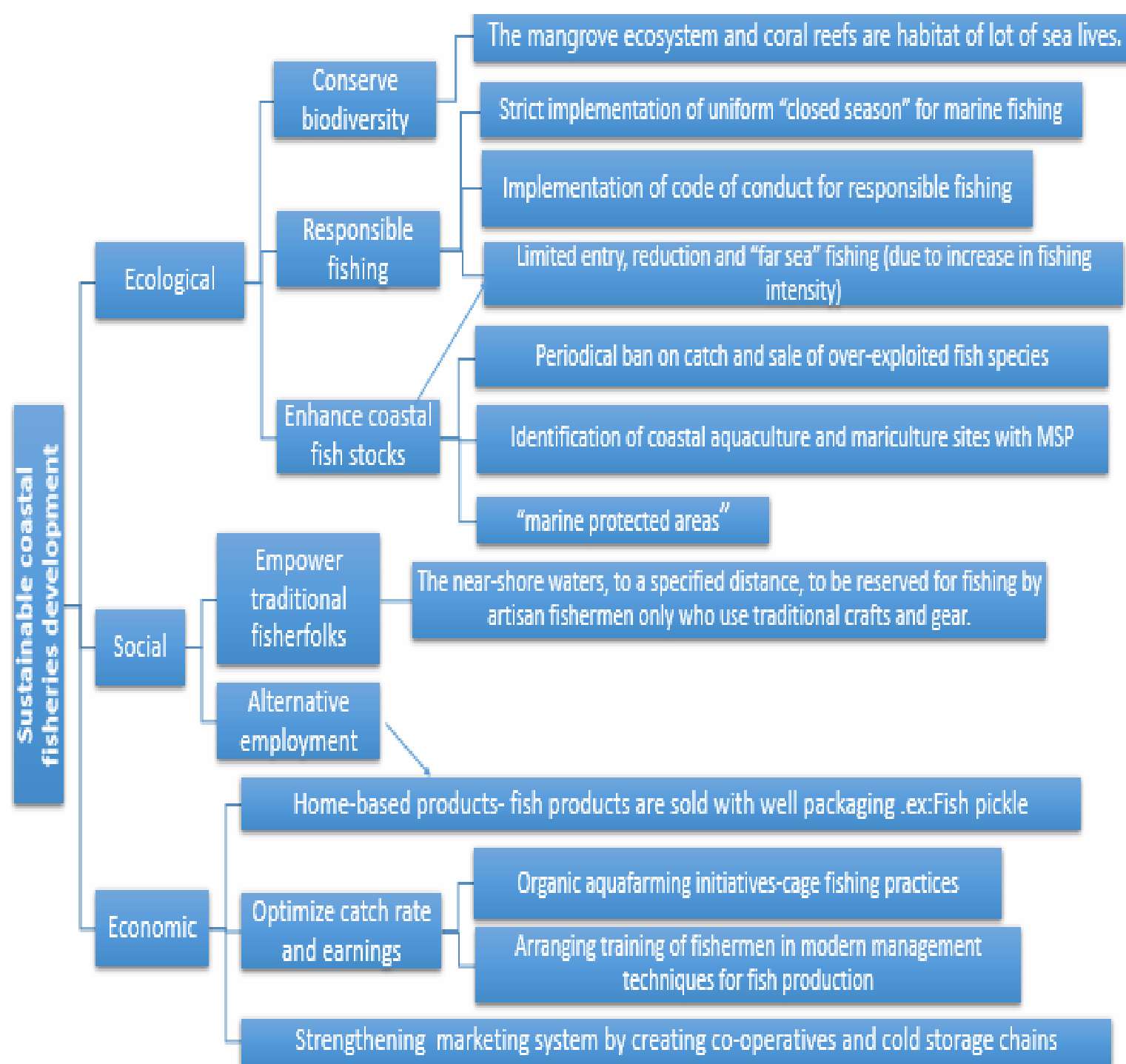
- shared wells used by a cluster of people within a neighborhood for domestic & irrigation purpose
- Located on possible lowest points in the identified neighborhood

Neighborhood level Vegetable garden

- interaction space, team work opportunity
- Addresses food security during off-season
- Opportunity for Women participation & Income generation

Support Centre

- Opportunity for education & business





Contents

PROJECT TEAM	iii
ACKNOWLEDGMENT	iv
EXECUTIVE SUMMARY	v
List of Tables	xviii
List of Figures	xix
List of Abbreviations.....	xxvii
1. Introduction	3
1.1. Understanding Sustainable Design in Spatial Development.....	3
1.2. Scales of Design.....	3
1.2.1. District level.....	4
1.2.2. Gram panchayat level	4
1.2.3. Project Level / Building Level	4
1.3. Concepts of Sustainability.....	4
1.4. Understanding the difference between need and greed	6
1.5. Perception of lifestyle.....	6
1.6. Urban Development.....	7
1.7. Progress towards Sustainable Design	7
1.8. Defining Settlement Design.....	8
2. Literature Study.....	10
2.1. A framework for sustainable cities:.....	10
2.2. Institutional Components and Sustainable Regional Development:.....	11
2.3. Understanding various approaches considered by different countries towards designing sustainable settlements:.....	12
2.4. Sustainable Settlement Planning in Indian Context:	13
2.5. Understanding the Concept of Smart Villages in India:	14
2.6. Understanding the relationship between Streets and Sustainable Settlement:.....	14
2.7. Vastu Shastra in Sustainable Town Planning:.....	14
2.8. Sustainability and Livability in Settlement Design:.....	15
2.9. Understanding the importance of Resilience in cities:	15
3. Structure of study	16
3.1 Survey Procedure and Approach Strategies:.....	16
3.2 Survey Approach Strategies:.....	16
3.3 Process and Timeline followed for Gram Panchayat Spatial Development Plan.....	16
4. Natural Setting- Kestra	23
4.1 Introduction	23
4.1.1 District profile	23
4.1.3 The ground water quality:	24
4.2 Study area.....	25

4.2.1 Udupi district	25
4.2.3 Uppunda Gram Panchayat.....	25
4.3 Climate:	25
4.3.1 Wind & Waves	26
4.4 Soil	26
4.5 Geology	27
4.6 Land use and land cover	28
4.7 Topography	29
4.8 Hydrology	30
4.9 Coastal Regulations.....	34
4.10 Flood Analysis	36
4.11 Earthquake Risk Assessment	38
4.12 Beach profile and volume change.....	39
4.13 Flora and Fauna	40
5. Inventory and Analysis of Natural Resources using Geospatial Technologies	41
5.1. Introduction	41
5.2. Objectives	42
5.3. Inventory of Natural Resources using High Resolution Satellite Data	42
5.3.1. Satellite datasets / Thematic database for developmental planning.....	42
5.4. Satellite Data Used.....	43
5.4.1. High Resolution Satellite Data (HRS data)	43
5.4.2. Very High-Resolution Satellite Data (VHRS data)	44
5.4.3. Digital Elevation Model (DEM)	45
5.5. Spatial Layers	45
5.5.1. Settlement and Transportation Layer	45
5.5.2. Land Use Land Cover Map (1:4,000 scale).....	46
5.5.3. Drainage network & surface water bodies	48
5.5.4. Slope Map.....	48
5.5.5. Geomorphology Map.....	49
1.1.1. Soil Texture Map	49
5.5.6. Contour Map	50
5.6. Derived spatial layers	50
5.6.1. Proximity analysis	50
5.6.2. Agriculture Map	51
5.6.3. Ground water quality Bore well location map.....	51
5.6.4. Ground water potential map	52
5.6.5. Rainfall & Runoff estimates	52
5.6.6. Household survey Data Analytics	53
5.7. Generation of comprehensive development plan for GP	54
5.7.1. Water Resources Development Plan.....	54
5.7.1.1. Rainwater harvesting	54



5.7.2.	Land Resources Development Plan (LRDP)	55
5.7.3.	Land Resources Development Plan general guidelines	56
5.7.4.	Recommendations & Suggestions for improving natural resources in Uppunda GP	57
6.	History and Heritage- Loka	61
6.1.	History of South Canara	61
6.2.	Historical timeline of rulers in South Canara	61
6.3.	Udupi District at a Glance	66
6.4.	Uppunda Gram Panchayat at a Glance	66
6.5.	History of Uppunda	67
6.6.	History of of Shri Durga Parameshwari temple:	68
6.7.	Timeline of rulers:	68
6.8.	The Nature worship:	69
6.8.1.	Worship of Sea:	69
6.8.2.	Worship of Tulsi and Tree:	69
6.8.3.	Worship of stone	70
6.8.3.1.	Significance of Naga shrine in Tulunadu culture:	70
6.9.	Major landmarks in Uppunda Village:	71
6.10.	Religious places in Uppunda village:	72
6.11.	Annual festivals and events:	73
6.11.1.	Kodi Habba:	73
6.11.2.	Uppundotsava or Beach festival	74
6.12.	Culture and lifestyle:	74
6.14.	Key Strategies	79
7.	Socio-economic-political structure- Desa	80
7.1.	Introduction	80
7.2.	Socio-economic Vulnerability	80
7.2.1.	Gram Panchayat Human Development Index	81
7.3.	Social- Economic Conditions of Uppunda GP.	81
7.3.1.	Demographic dividend in Uppunda	81
7.3.2.	Main and marginal working population in Uppunda	82
7.3.3.	Socio- Economic infrastructure	82
7.3.4.	Skill Levels among the youths in Uppunda GP	84
7.3.5.	Target segments for Skill Development and Vocational Training	84
7.3.6.	Context for Skill Development Policy	85
7.3.7.	Skill and Vocational Development Specifics	85
7.4.	Aims and Objectives of the Skill Development Policy for Uppunda	86
7.5.	Strategic focus areas: Skill – Entrepreneurship – Livelihood Development	87
7.5.1.	Policy Intervention Strategies:	87
7.6.	Site selection and potential for Skill development and Vocational Training Centre	88
7.7.	Economic Development Centre in Uppunda.	89

7.7.1.	Introduction	89
7.8.	Proposal for Economic Development Centre in Uppunda.	90
8.	Physical Infrastructure- Desa	92
8.1.	Housing.....	93
8.2.	Identification of Issues.....	93
8.3.	Existing guidelines regarding Built Form.....	95
8.3.1.	CRZ Guidelines.....	95
8.3.2.	Policies Related to Housing.....	96
8.4.	Road Infrastructure.....	96
8.5.	Existing Guidelines and policies for Rural Road Development	101
8.5.1.	Pradhan Mantri Gram Sadak Yojana (PMGSY).....	101
8.5.2.	National Rural Roads Development Agency (NRRDA).....	102
8.5.3.	Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)	102
8.6.	Water Management.....	102
8.6.1.	Identification of Issues	103
8.6.2.	Existing guidelines regarding Built Forms.....	104
8.6.2.1.	Multi-Village Drinking Water Supply Scheme – Gadag District, Karnataka, India	104
8.6.2.2.	Karnataka Rural Water Supply Project (KRWSP)	104
8.6.2.3.	Bhungroo- Ground Water Injection Well.....	105
8.6.3.	Adaptive Water Management in Chinchojhar village, Valsad, Gujarat	105
8.7.	Solid Waste Management	106
8.7.1.	Identification of Issues	107
8.7.2.	Existing guidelines, Policies and Best practices.....	109
8.7.2.1.	Holistic management System	109
8.7.2.2.	Composting at Household level	110
8.7.3.	Nivedha Trashbots	110
8.7.4.	Thin plastics to fashionable accessories – upcycling method; case study in assam	110
8.7.5.	Bio- digesters	111
8.7.6.	Swachh India (Govt. Scheme).....	112
9.	Proposed Masterplan and Recommendation	113
9.1.	Vision Statement.....	113
9.2.	Proposal Brief.....	113
9.3.	Recommended Guidelines for Spatial Development Proposal for Uppunda Village.....	116
9.3.1.	Coastal Protection through propagating Coastal Vegetation Growth and Landforms for Uppunda Village 116	
9.3.1.1.	Protection of Mangroves	116
9.3.1.2.	Sand Dunes.....	116
9.3.1.3.	Sustainable coastal fisheries development in Uppunda Village	116
9.3.1.4.	Conserving Biodiversity	117
9.3.1.5.	Mangrove planting and protection	117
9.3.1.6.	Riparian Zone.....	117



9.3.1.7.	Identification of coastal aquaculture and Mari culture sites with MSP.....	118
9.3.1.8.	Safeguarding the livelihood security of the artisan fisheries	118
9.3.1.9.	Promoting sustainable utilization of marine/estuarine fish	118
9.3.1.10.	Strengthening marketing system by creating cold storage chains	119
9.4.	Sustainable Beach tourism and Heritage walk in Uppunda Village.....	119
9.4.1.	Conservation of Cultural heritage	119
9.4.2.	Improve Infrastructure, Tourism Products and Services	119
9.4.3.	Information, Communication & Technology (ICT)	120
9.4.4.	Tourism products and services.....	120
9.4.5.	Heritage Walk.....	121
9.5.	Enhancing Neighborhood level development in Uppunda Village	122
9.5.1.	Delineation of the demo areas	122
9.5.2.	Community Wells.....	122
9.5.3.	Neighborhood level Vegetable Garden	122
9.5.4.	Neighborhood level common working space:.....	123
9.5.5.	Support Center:	123
9.6.	Skill development and Vocational Training Centre	123
9.6.1.	Skill Development and vocational Training center:.....	123
9.6.2.	Formulation for a Core team and training:.....	123
9.6.3.	Signing of Course Curriculum and facilities:.....	124
9.6.4.	Village Economic Development Center:	124
9.7.	Road Infrastructure	124
9.7.1.1.	Ring Road (Loop System):.....	124
9.7.1.2.	Intervention of Road Edges:.....	124
9.7.1.3.	Provision of Street Lights along roads:.....	124
9.7.1.4.	Provision of Bus Stop:.....	125
9.8.	Housing Typologies & Design and Construction	125
9.8.1.	Design Layout:	125
9.8.2.	Construction Material & Techniques:	125
9.8.3.	Design aspects for floods:.....	126
9.8.4.	Design Consideration for Plinth:.....	126
9.8.5.	Rainwater Harvesting in Household Level:.....	127
9.9.	Water Management	127
9.10.	Waste Management	127
9.11.	Design Proposal for Village Spatial Development.....	128
9.11.1.	Proposal for Coastal Protection	128
9.11.2.	Natural Assets of the Coast:	129
9.12.	Sustainable coastal fisheries development:	136
9.12.1.	Part-1: Proposal is conserving biodiversity:.....	136
9.13.	Proposal for Enhancing Neighborhood level development for Uppunda Village.....	141

9.13.1.	Delineation of the demo areas of rescue zone cum community support centre and justification	143
9.13.2.	Community Wells	144
9.13.3.	Neighborhood level Vegetable garden	145
9.13.4.	Proposal for Neighborhood level common working space for Uppunda Village.	145
9.13.5.	Support center.....	146
9.14.	Proposal for Heritage walk and Beach Tourism for Uppunda Village.	147
9.14.1.	Heritage Walk Development:.....	149
9.15.	Proposal for Skill development and Vocational Training Centre at Uppunda Village.	153
9.15.1.	Area Statement of Proposed Built form:	154
9.15.2.	Guidelines for Setting up of Skill Development Centre under Pradhan Mantri Kaushal Kendra.	155
9.15.3.	Policy Guidelines for Setting up a skill development center under Pradhan Mantri Kaushal Kendra.....	156
9.16.	Proposal for Economic Development Centre at Uppunda Village.....	157
9.17.	Proposal for Road Infrastructure at Uppunda Village	161
9.17.1.	Developing a loop system:	163
9.17.2.	Improving the road section:	163
9.18.	Housing Typologies & Design and Construction	164
9.18.1.	General Characteristics.....	165
9.18.2.	Proposed guidelines.....	165
9.18.3.	Design aspects for floods	166
9.18.4.	Design Consideration for Plinth	167
9.18.5.	Rainwater Harvesting in Household Level.....	167
9.19.	Water Management	168
9.19.1.	Water Retention Pond.....	169
9.19.2.	Herrinbone Drainage Pattern.....	170
9.20.	Solar Distillation.....	171
9.20.1.	Canal Embankment	171
9.20.2.	Pond Enlargement	171
9.21.	Waste Managements.....	172
	172
9.21.1.	Holistic Waste Collection System	172
9.21.2.	Composting.....	174
9.21.3.	Trashbot at Site Level	175
9.21.4.	Thin Plastic Converted to Plastic Bags.....	175
9.21.5.	Bio- Digester	176
9.21.6.	Shrimp Farming.....	177
10.	References	178
11.	Annexure I On-site Observation Check List:	182
8.	Schooling and Education	183
12.	Annexure II Survey Form	185
	Survey Form - English	185
	Survey Form - Kannada.....	186



13.	Annexure III - Natural Setting	188
14.	Annexure IV - Ground Water Table – Udupi District	193
15.	Annexure V - Wetland – Udupi District	194
16.	Annexure VI – Road Infrastructure – Planning and Policies.....	196
	4.Indian Road Congress (IRC: SP:20-2020).....	200
16.	Annexure VII – Infrastructure at Uppunda.....	204
17.	Annexure VIII – CRZ Regulations.....	207
18.	Annexure IX – Action Plan Recommended for Safeguarding of Biodiversity.....	212

List of Tables

Table 1-1 Global statistics on urbanization, energy and resource use compiled from tables published by the World Resource Institute	7
Table 4-1 Cropping pattern in Udupi district, Karnataka.....	24
Table 4-2 Physico-chemical quality parameters results of groundwater samples in well, municipality supply and river Uppunda Gram panchayat, Udupi, Karnataka.	31
Table 5-1: Information sources for development planning.....	43
Table 5-2 Derived spatial databases required for planning	43
Table 5-3 Road length for different Road categories in Uppunda GP.....	45
Table 5-4: Areal spread of different Settlement categories in Uppunda GP	46
Table 5-5 Area estimates of various LULC classes in Uppunda GP (1:4k map).....	47
Table 5-6 Statistics of drain length for Uppunda GP	48
Table 5-7: Ground Water Quality Parameters – Uppunda GP.....	52
Table 5-8 Temporal variability of Rainfall and Runoff estimates for Uppunda GP	52
Table 6-1 Calendar of festivals and events	73
Table 6-2 Showing the inferences, Source: GP Survey Team, MSAP	78
Table 6-3 Showing the Key Strategies.....	79
Table 7-1 Socio-Economic Aspects of Udupi District	80
Table 7-2 District-wise Vulnerability Indices of Karnataka (Source: Karnataka Climate Change Action Plan)	81
Table 7-3 Human Development Index Uppunda (Human Development, Performance of GP's in Karnataka, 2015)	81
Table 7-4 Socio-Economic Infrastructure of Uppunda. (Source: District Census Handbook, Udupi, DCO, Karnataka Ministry of Home Affairs)	83
Table 8-1 Observation of Uppunda Housing Conditions (MSAP, 2020)	94
Table 8-2 The list of recyclable waste collected by the waste collector; and non-recyclable waste that are thrown into the natural water course and backwaters	107
Table 8-3 Issue identification in each ward for waste management collection.....	108
Table 9-1 Table showing functional parameters with respect to seashore type and jetty type.....	133
Table 9-2 Table showing the details of Services in Support Centre	146
Table 9-3 Table showing the intervention zone possible.....	151
Table 9-4 Economic Development Planning	157
Table 9-5: Stages of Road Infrastructure Development	161
Table 0-1 Flora and Fauna in Udupi, Karnataka	188



List of Figures

Figure 2-1: Pillars for achieving sustainability of cities	10
Figure 2-2 Munasinghe's Approach to Sustainable Development Source: Adapted to Pearce, 1999.	11
Figure 2-3: Daly's Triangle of Equity, Economy, and Environment	11
Figure 2-4: The six major systems of the anthroposphere and their major relationships	12
Figure 2-5 Characterization of sustainable development: the interaction between economic, environmental, human and institutional domains.....	12
Figure 4-1 Uppunda location map.	23
Figure 4-2 Study area location map.....	25
Figure 4-3 Udupi District Map,	25
Figure 4-4 Climate summary	26
Figure 4-5 Uppunda Soil Pattern, Source: NRSC Prepared by MSAP GPSDP Team	27
Figure 4-6 Soil Map of Udupi District, Source: Pradhan Mantri Krishi Sinchayee Yojana.....	27
Figure 4-7 Uppunda Soil Pattern Percentage,	27
Figure 4-8 Uppunda Lithology Map	27
Figure 4-9 Udupi Geology Map	27
Figure 4-10 Uppunda Soil + Built up Map,	28
Figure 4-11 Uppunda Geomorphology Map	28
Figure 4-12 LULC of Udupi District.....	28
Figure 4-13 Uppunda Land use /Landcover	28
Figure 4-14 Uppunda LULC Percentange	29
Figure 4-15 Physiography Map of Udupi District showing location of Uppunda village	29
Figure 4-16 Uppunda Contour & Builtup Map.....	29
Figure 4-17 Schematic Section at section line (red dash line) shown in Fig. 4-15 ;.....	30
Figure 4-18 Slope analysis;.....	30
Figure 4-19 Uppunda Drainage & Surface Waterbodies.....	31
Figure 4-20 Drainage map of Udupi District.....	31
Figure 4-21 Analysis of collected water samples;	32
Figure 4-22 Figure 4-23 Drainage and Hydrograph Monitoring Stations, Udupi District,	33
Figure 4-24 Drainage and Hydrograph Monitoring Stations, Udupi District,	33

Figure 4-25 Hydrogeology, Udupi District,	33
Figure 4-26 Hydrogeology, Udupi District,	33
Figure 4-27 Depth to Water level Pre monsoon, Udupi District,	34
Figure 4-28 Depth to Water level Post monsoon, Udupi District,.....	34
Figure 4-29 Depth to Water level Post monsoon, Udupi District,.....	34
Figure 4-30 Depth to Water level Pre, Udupi District.....	34
Figure 4-31 Risk Assessment Maps	36
Figure 4-32 Flood Impact Maps,	37
Figure 4-33 Schematic Sections,	37
Figure 5-1 Study area location map for pilot GPs of Karnataka under GPSDP	42
Figure 5-2 Uppunda GP as seen through HRS data in NCC mode (2.5m).....	44
Figure 5-3 Uppunda GP as seen through VHRS data in FCC mode (0.7m).....	44
Figure 5-4 Digital Elevation Model of Uppunda.....	45
Figure 5-5: Settlement and Transportation Network of Uppunda GP	46
Figure 5-6 LULC map of Uppunda GP at 1:4k scale	47
Figure 5-7 Drainage and surface water bodies of Uppunda GP	48
Figure 5-8 Slope map of uppunda GP	48
Figure 5-9: Geomorphology map of Uppunda GP.....	49
Figure 5-10 Figure 5-11 Soil texture map of Uppunda GP	49
Figure 5-12 Contour map of Uppunda GP	50
Figure 5-13 Proximity of Uppunda GP to nearest towns Bhatkal and Kundapura.....	50
Figure 5-14 Agriculture Map of Uppunda GP	51
Figure 5-15 Ground water Quality bore well location map of Uppunda GP.	51
Figure 5-16 Ground water potential Map of Uppunda GP	52
Figure 5-17 Location of household survey	53
Figure 5-18 Distribution of Household based on house type	53
Figure 5-19 Distribution of Household based on water availability	53
Figure 5-20 Household Distribution (Kuccha and Semi Pucca based on Landholding	53
Figure 5-21 Household distribution based on Solid waste management	53
Figure 5-22 Household Distribution based on Living condition.....	53
Figure 5-23 Household distribution based on Toilet availability	54
Figure 5-24: Water Resource Development Plan of Uppunda GP.....	56



Figure 5-25: Land Resource development Plan of Uppunda GP	56
Figure 6-1 Shatavahana Empire.....	62
Figure 6-2 Ratrakutha of Malakeada	62
Figure 6-3 BanavasiKadamba	62
Figure 6-4 Chalukyas of Kalyana	62
Figure 6-5 Gangas of Talakad.....	62
Figure 6-6 Sevunas of Devagiri	62
Figure 6-7 Chalukyas of Badam	63
Figure 6-8 Hoyasalas of Dwarasamudra	63
Figure 6-9 Vijayanagara	63
Figure 6-10 Odeyars of Mysore	63
Figure 6-11 Bahmani.....	63
Figure 6-12 Nayakas of Chitradurga.....	63
Figure 6-13 Sultans of Bijapur	64
Figure 6-14 Sultanate of Srirangapatana.....	64
Figure 6-15 Nayakas of Kelaedi	64
Figure 6-16 Mysore Odeyars.....	64
Figure 6-17 British Takeover	64
Figure 6-18 Mysore Wodeyars	64
Figure 6-19 Karnataka Govt	65
Figure 6-20 Evolution of Tulunadu_: Udupi study report.....	65
Figure 6-21 Udupi District Tourism	66
Figure 6-22 : Location map of Uppunda	67
Figure 6-23 Shri Durga Parameshwari temple, Uppunda	68
Figure 6-24 Tulsi Katte at entrance of houses in Uppunda	69
Figure 6-25 Tulsi Katte at entrance of houses in Uppunda	69
Figure 6-26 Peepal Tree worship in Uppunda Gp.....	70
Figure 6-27 Prayer of their Moola (Origin) Nagadevatha which their ancestors were related to.....	70
Figure 6-28 Bijooru shree arekallu naga (snake shrine) in Uppunda	70
Figure 6-29 Map showing major landmarks in Uppunda village,	71
Figure 6-30 Map showing Religious places in Uppunda,	72

Figure 6-31 Map showing Temple evolution in Uppunda,	72
Figure 6-32 Aerial view at the time of Kodi Habba.	73
Figure 6-33 Uppundotsav happening at Madikal beach.	74
Figure 6-34 Yakshagana,	74
Figure 6-35 Fishermen community in Uppunda.	75
Figure 6-36 Kadiru Habba celebration,	75
Figure 6-37 Map showing the Madikal beach area where the festival Uppundotsava is happening.....	75
Figure 6-38 Communities and coastal area of Karnataka, India. involved in small-scale cage culture	76
Figure 6-39 Map showing demo area in Ward 7.	79
Figure 6-40 Nagabhana of Uppunda village,.....	79
Figure 7-1 Composite index of Vulnerability across Districts of Karnataka	80
Figure 7-2 Demographic dividend (economic activity wise) in Uppunda.....	81
Figure 7-3 Graph depicting main and marginal working population in Uppunda.....	82
Figure 7-4 Economy Aspects of Wards in Uppunda.....	82
Figure 7-5 Other social infrastructure facilities in Uppunda	84
Figure 7-6 Major employment sectors as per skill development by 2030	84
Figure 7-7 Approach for Skill Development in Uppunda.....	86
Figure 7-8 Kannada translator and Online portals/ Mobile apps for Social Networking	87
Figure 7-9 Collaborative Approach for Skill Development in Uppunda	88
Figure 7-10 Site identification.	88
Figure 7-11 Proposed Site Area	89
Figure 7-12 Uppunda Bus Stop along NH.....	89
Figure 7-13 Strategic Development for Uppunda Economic Development Centre.	90
Figure 7-14 Economic Development Planning,	90
Figure 7-15 Site Identification for Economic Development Centre at Uppunda,	91
Figure 8-1 Maslow Hierarchy of people Need (Poirier).....	92
Figure 8-2 Housing Typology.....	93
Figure 8-3 Percentage of residences on the basis of their existing conditions	93
Figure 8-4 Percentage of residences based on their construction type	93
Figure 8-5 Percentage of residences on the basis of their existing conditions	93
Figure 8-6 Example of Typical layout of Uppunda Houses.....	94
Figure 8-7 Road Network	97



Figure 8-8 Map Showing Google earth map and GIS Generated Road Map for Uppunda Village	97
Figure 8-9 Settlement and Road Layout of Uppunda GP.....	98
Figure 8-10 Map showing Figure Ground of Uppunda Village	99
Figure 8-11 Map Showing Hierarchy of Existing Roads in Uppunda Village	100
Figure 8-12 (a) Coastal Road, (b) Narrow road with 3-4 mt wide, (c) Inadequate Drains..	101
Figure 8-13 Detail at B on key plan	101
Figure 8-14 Detail at A on Key plan on Figure 8.11	101
Figure 8-15 Detail at c on key plan Figure 8.11	101
Figure 8-16 : Schematic Section of ward 10, 9, 1,	103
Figure 8-17 Ward Map with Natural Drainage,	103
Figure 8-18 Schematic Diagram	105
Figure 8-19 Water Bodies in Uppunda,	105
Figure 8-20 Flow chart representing the waste at the village – Uppunda.....	106
Figure 8-21 Waste Disposal at Uppunda Gram panchayat	106
Figure 8-22 Existing condition of Uppunda with Solid waste disposal.....	108
Figure 8-23 From linear to circular holistic waste management practice,.....	109
Figure 8-24 General composting method,	110
Figure 8-25 The process of Trashbot model by Nivedha,	110
Figure 8-26 New products made of plastic waste	111
Figure 8-27 : Process of the bio-digestive system	111
Figure 8-28 : Process of waste collection	112
Figure 9-1 Village Development Goals	113
Figure 9-2 : Proposed Master plan at Uppnda Gram Panchayat	115
Figure 9-3 Types of sand dunes,.....	129
Figure 9-4 Wind leading to the deposition of sand creating a sand dune.	129
Figure 9-5 Example showing bio-zones for Cavellossim Beach Dune Restoration,	130
Figure 9-6 Proposal for Coastal Protection of Uppunda Village	131
Figure 9-7 : Proposed and Existing Mangrove Vegetation through introducing Riparian zone in the site.....	132
Figure 9-8 Existing Section AB at North-end of Uppunda's Coast- Madikal Beach	132
Figure 9-9 : Proposed Section AB at North-end of Uppunda's Coast- Madikal Beach	133
Figure 9-10 Shoreline Protection.....	133

Figure 9-11 Map Showing Coastal Belt adjacent to Ward 10 and Ward 8.....	133
Figure 9-12 Stage 1 – the normal waves when hit the sand dunes (b) Stage 2 – The initial attack of storm wave.	134
Figure 9-13 Technique for the shoreline, source: Geography, geographers – Swallow Hill community college.....	134
Figure 9-14 Key Objectives of Sustainable Fisheries Development.	135
Figure 9-15 Technique for the shoreline, source: Geography, geographers – Swallow Hill community college.....	135
Figure 9-16 Proposal for sustainable coastal fisheries development for Uppunda Village.....	137
Figure 9-17 Conceptual model depicting the mechanisms by which riparian regulation of energy	138
Figure 9-18 location of mangroves and riparian zone.	139
Figure 9-19 zones marked i for coastal aquaculture and mariculture sites	139
Figure 9-20 Development Proposal for Coastal Zone Protection with Fisheries Development	141
Figure 9-21 Proposal for Neighborhood development in Uppunda Village	142
Figure 9-22 the map of Uppunda village with the delineated areas in the selected wards.....	143
Figure 9-23 Map showing the possible location for community wells	144
Figure 9-24 prototype of community well	145
Figure 9-25 conceptual sketch of vegetable garden.....	145
Figure 9-26 Poposed sites for community support centre	146
Figure 9-27 Proposed Prototype of Support center in Uppunda village	147
Figure 9-28 location of support centre	147
Figure 9-29 concept of Culture of Heritage Management.....	148
Figure 9-30 Objectives of Heritage conservation and Management.....	148
Figure 9-31 Map showing development of Heritage walk loop	150
Figure 9-32 Landmark map including the tourist trail with ped shed analysis for the pause points.	152
Figure 9-33 a) Entrance Gate, (b) Waiting Areas, (c) Proposed Temporary Shacks	152
Figure 9-34 : Conceptual sketch for Building Complex for Skill development and Vocational Training Center)	153
Figure 9-35 : Skill development and Vocational Training Centre – Building complex	153
Figure 9-36 Site plan for Skill development and Vocational Training centre.....	155
Figure 9-37 Strategic Development for Uppunda Economic Development Centre.	157
Figure 9-38 conceptual design of economic development centre.....	157
Figure 9-39 Canteen area with informal sitting.....	158
Figure 9-40 retail and wholesale market sketch.....	158
Figure 9-41 Traditional methods vs Modern equipped methods for Fish Drying.....	159
Figure 9-42 : Process of Shrimp Papad manufacturing.....	159



Figure 9-43 Manufacturing Process of Fish Pickle.....	160
Figure 9-44: Manufacturing Process of Puffed Rice	160
Figure 9-45 Coconut Defibring	160
Figure 9-46 Coconut Storage	161
Figure 9-47 Base Map for Proposed Loop System for Road Infrastructure.....	162
Figure 9-48 : Phase 1 Intervention Details (a) Maximum Kerb height, (b) Storm Water Management	162
Figure 9-49 a) Existing Mud Road Condition, (b) Proposal for Phase 1, (c) Proposal for Phase 2 & Phase 3, (d) Typical Cross section of Road Design.....	163
Figure 9-50 Street Light Fixture Detail.....	164
Figure 9-51 Map with selected areas for Demo proposals.....	164
Figure 9-52 recommended shapes and forms to resist the wind.....	165
Figure 9-53 layout of typical dwelling.....	166
Figure 9-54 : Conceptual sketch of layout of a typical dwelling near the NH 66.....	166
Figure 9-55 Typical settlement design aspects for low lying area	167
Figure 9-56 Details of cement-stabilized plinth	167
Figure 9-57 Brick plinth construction.	167
Figure 9-58 Cement concrete flooring detail.....	167
Figure 9-59 Rooftop rain water harvesting for rural households	168
Figure 9-60 Proposed map for Water Management at Uppunda	169
Figure 9-61 plan and section of water retention pond.....	169
Figure 9-62 Herringbone Drainage Pattern & Uppunda Map showing Layout of Proposed Herringbone drainage.	170
Figure 9-63 a): Plan of Pond Area,	170
Figure 9-64 Solar Distillation Process, Source – Waster water Engineering: Treatment and Reuse.....	171
Figure 9-65 Canal Embankment Section,	171
Figure 9-66 Proposed Map Depicting Center for Managing Waste at Uppunda.....	172
Figure 9-67 Segregation of Solid Waste.....	173
Figure 9-68 The holistic management system that can be incorporated in Uppunda	173
Figure 9-69 The compost pit	174
Figure 9-70 The arranged layer in the box compost,	174
Figure 9-71 <i>Detail of Trasbot Center in Ward</i>	175
Figure 9-72 (1)Community level working space ,.....	176
Figure 9-73 Schematic representation - toilets connected to the inlet of the bio-digester ,.....	176

Figure 9-74 (1)The bio-digesters are reduced to 2 chambers with respect to the capacity; (177
Figure 9-75 Detail of Proposed Bio- Digester.....	177
Figure 9-76 End products of organic decay	177
Figure 13-1 Extent of fishing ground and intensity of fishing at different fishing ground	191
Figure 13-2 Distribution of reef related species.....	191
Figure 13-3 Critical ecosystem identified with respect to juvenile fishery of threadfin bream, one of the major species along the south-west coast of India	192
Figure 13-4 Statistical Data for Ground Water in Udupi District,2008.....	193
Figure 13-5 Statistical Data for Ground Water in Udupi District, 2012.....	193
Figure 13-6 Map of wetland in Udupi District as per National Wetland Atlas by ISRO, Aug 2010.....	194
Figure 13-7 Map of wetland in Udupi District as per National Wetland Atlas by ISRO, Aug 2010.....	195
Figure 13-8 The Standard Dimensions of the logo PMGSY,	198
Figure 13-9 Direction Boards, PMGSY	198
Figure 13-10 Information Board 2 and 3, Source: (https://www.pmgysy.nic.in/ , n.d.)	198
Figure 13-11 Cautionary Signs, Source: (https://www.pmgysy.nic.in/ , n.d.)	199
Figure 13-12 Direction Boards, Source: (https://www.pmgysy.nic.in/ , n.d.)	199
Figure 13-13 A. Cross Section for Rigid Pavement,	199
Figure 13-14 A.Section of PMGSY road,	200
Figure 13-15 Approach to Rural Road planning Block-wise Invalid source specified.....	200
Figure 13-16 (A)Image illustrating the roadway width optimum for rural areas,	202



List of Abbreviations

DEM	Digital Elevation Model
DOP	Date of Pass
FCC	False Colour Composite
GIS	Geographic Information System
GP	Gram Panchayat
GPS	Global Positioning System
GPSDP	Gram Panchayat Spatial Development Plan
HRS	High Resolution Satellite
ICT	Information and Communication Technology
IRS	Indian Remote Sensing
IMD	India Meteorological Department
IMSD	Integrated Mission for Sustainable Development
ISRO	Indian Space Research Organisation
KRSRAC	Karnataka State Remote Sensing Application Centre
LISS	Linear Imaging Self Scanner
LRDP	Land Resources Development Plan
LULC	Land Use Land Cover
MoPR	Ministry of Panchayati Raj
NCC	Natural Colour Composite
NIC	National Informatics Centre
NRIS	Natural Resources Information System
NRSC	National Remote Sensing Centre
RC	Regional Centre
RS	Remote Sensing
SIS-DP	Spatial based Information Support for Decentralized Planning
VHRS	Very High Resolution Satellite
WRDP	Water Resources Development Plan



1. Introduction

Before diving into the topic of spatial planning and settlement, one needs to be able to distinguish between urban and rural and understand what the future of our city is going to be? Is the Urban Development going to remain the way it is now or is the rural development going to remain the way it is now? Many of them have contemplated this and have come up with different types of solutions. In fact, if it is seen very critically the Urban Development is moving towards a semi-rural type of development, and rural development is moving towards urban infrastructure with rural ideology. Further if looked at the practical on-ground development it is seen that there are Industries, certain Institutions popping up, without any defined planning guidelines put in place for this kind of development in the rural areas and these are creating an imbalance in the ecosystem of the rural area. So, this Rural Spatial Development project becomes important because it has come at such a phase of the developments where one must decide how rural areas are going to be in the coming 20-30 years. There is a need to establish the role of these areas and how this divide between Urban and Rural can be eradicated by developing an ideal settlement pattern. These settlement patterns may be different from what is seen in cities, but the main aspect of these patterns is how it is designed and whether it addresses and reduces the problems faced in terms of migration, poverty, lack of housing, environmental problems, pollution and now at present the issue of the pandemic. This spatial planning can be used as an opportunity to redefine the development in a rural area in a way that is more sustainable and in a way that addresses the above issues while moving forward for better settlement design.

1.1. Understanding Sustainable Design in Spatial Development

What is Sustainable Design? When the word sustainable is being used, in simple language it means which can last which can be maintained over a long period of time. It goes beyond the economic parameters of GDP, density and turnover. But many a times when sustainable settlement is considered, it is still measured in terms of density of population, the turnover of the economic parameters, the overall GDP, and the per capita income, but is it really defining sustainable? Is sustainable about the consumption parameters that one wants to define an Urban Development as or should it be a broader picture of what can last? So that is one question that needs to be answered or redefined.

The next question is how can anything be defined as development? It is usually assumed that development is better, it gives more opportunities and gives better facilities but normally it is associated with the growth of something different and bigger, bigger is considered better and different is considered great. But development is not just about being bigger and better or being different, it is also about knowing that it will make things better for the people so at times even things like restricting a development beyond a certain level, restricting number of people beyond a certain level, preventing any kind of development in a no-development zone or in critical natural hubs in order to maintain balance in the environment is also considered as part of the development. Development is not about just building and construction by man, but it is also keeping things in control in a way such that it makes a more balanced habitat.

So sometimes not doing anything, not growing bigger, putting limits on growth and development of buildings can also become a type of development. At times, these types of development are what make things more sustainable.

1.2. Scales of Design

Whenever any design is considered, it needs to be inferred through different scales of design. From the product to energy, from lifestyle design to building design, from sector level design and planning to city level design and planning and all this coordinated with regional level design and planning.

When the different scales of designs are considered especially in sustainable design, the impact of each of these scales increases with increasing scales or it can also be explained as the savings of energy or aspects of sustainability is higher as the scale increases. However, the ease of implementation of the design or the challenges faced by putting it on the ground increases with an increase in scale, that is, the ease of implementation becomes more and more difficult as the scale increases and it's much easier at the product level. So, in short, it can be said that the impact is inversely proportional to the ease in which these sustainable designs can be implemented.

However, that does not mean that any scale can be given less or more importantly, it is a cumulative effect of all these scales that will only enable one to have truly sustainable design and development.

1.2.1. District level

While designing, vision plays a very important role. It is always preferred to have a vision and a schematics or strategic plan at an overall level. Even though there are different commissions and government bodies like the Planning Commission and the statements by the Central Government on their vision for the country and different goals assigned for the development of the country. However, there is a need for more detailed design and strategy at a Regional level where partially spatial planning, economic planning, and policy planning, are developed. At later stages, it penetrates the city where a more detailed development plan along with the land use plan, policies, by-laws are prepared in a more structured manner and finally, sector-level planning is done where spaces are designated, land use is designated, types of building typology is defined. This stage is very critical because it ensures a sustainable design infrastructure at an overall scale, this has a bigger impact than any green building or a green product. So, this is a very critical aspect of design or vision which is considered primarily.

1.2.2. Gram panchayat level

Another, very critical and important is the stage of creating a form or morphology of design which includes the building typology, the by-laws, understanding the different typologies of building in terms of their heights, FAR and the lifestyles of people going to be residing there and how it is going to be moderated in terms of consumption of water, consumption of energy, the types of gadgets used, the types of produce and the waste management, the supply of power in terms of generation of alternative energy, and the types lighting fixtures for various equipment, all of these needs to be standardized or a benchmark needs to be set. After which the overall infrastructure, the types of the benchmark are set for the people in terms of education, in terms of health benefits, in terms of access to the Internet, mobile network. The different methodologies to set standards for infrastructure are followed such that it is available to each and every citizen of that settlement. This is the second stage of design, and this needs to be detailed out before committing to any kind of long-term development strategy along with a complete cost-benefit analysis that needs to be done along with detailing, and the amount of investment needs to be detailed out, while also establishing the impact and the appropriate scale and intensity that can be allowed. These decisions need to be made before the development takes place and not after. In the second stage, the further details are worked out thus making it equally important and critical as the first stage.

1.2.3. Project Level / Building Level

This stage of design is again very important for implementation and the practical layout of this is to give the facilities to enable people, to enable the planning such that it is in accordance to the vision developed in the first and the second stage. This means that the products, the type of material for the green building, the kind of products that people would be using, the kind of facilities given for waste management and rainwater harvesting, are all in place and the detailing of these aspects is done very critically. So, when the implementation is considered, it starts with the third stage, moving towards the second stage and then finally the first stage of design. Whereas in terms of thinking and/or designing it is the first stage that comes first and then it moves on to the second stage, lastly followed by the third stage. When summed up it can be said that thinking is more from first to second to the third stage, while implementation moves from the third stage to the second and then to the first stage of design in terms of scales and implementation. So, until and unless the products and the facilities are not available in the market, it becomes difficult to achieve the goal of the vision and plan of design for the buildings, for the infrastructure for the region and the city.

1.3. Concepts of Sustainability

The concept of sustainability can be based on the consumption pattern because Urban Development or measure of a lifestyle has always been based on the consumptions, the kind of house, the size of the house, the types of materials used, the kind of lifestyle, the amount of food being produced. But slowly because of the idea of the concept of sustainability, people have realized that the total consumption amount must be reduced as much as possible and use



only what is required and not waste. Similarly, reducing is further followed by the idea of reuse, So, certain aspects of a product that can be reused or even recycled are encouraged rather than the products that are one-time use and need to be disposed of. Both the plastic cutlery and vessels have been considered to understand which amongst the two is a better option in terms of consumption. Hence it can be said that the concept of sustainability initially started with measuring consumption and slowly it moved towards impact assessment. If certain types of construction or change in the landscape are done, it becomes very important to understand the impact and outcome of these changes and the replacement they result in. So, with the environmental impact assessment, one tries to establish the type of replacement and the energy it consumes, the impact of these new materials used, the effect of it in terms of nature, in terms of the value of it, in terms of the carbon footprint, carbon use of oil, fuel everything converted to the carbon footprint. Thus, impact assessment became another measure that helped to make better decisions towards sustainable design. Today, there is a new idea of a circular economy where products are evaluated based on the whole life cycle in terms of seed to soil as it is called. It is the type of analysis that starts from understanding the raw material and how it is procured and the kind of consumption of water and the impact it has on the environment. It also involves understanding how the raw material is processed and again at every stage of the product right from manufacturing, to use, to disposal, the impact of the product on the environment and how much energy does it consume, how much water does it consume is understood and looked into, followed the rating of the product which is done to establish if the product is eco-friendly, environmental friendly, is it energy efficient. These ratings are done using the star rating systems, or through eco-labels, or the green building rating systems, all of which are based on the LCA or life cycle assessment.

When the complexity of a city or a region is considered, it would be rather difficult to give complete justice to the concept of sustainability in terms of consumption, impact, or circular economy. The thinking or thought process must go beyond that because there are lots of complex networks of social aspects, economic aspects, spatial aspects, climatic aspects, and geological aspects. The best source of learning can be obtained directly from nature and it can be mimicked to develop a better sustainable design. Nature has always maintained a very good balance within its ecosystem and if observed very critically one would see that there is no concept of waste in an ecosystem, the waste of one species or an event becomes the raw material for the next species or the next event and it goes back cyclically without any generation of waste that way the whole ecosystem including what the humans do becomes a balanced act. Now the same ideology needs to be applied and developed for the cities, where there is no concept of waste, every aspect takes place in a more balanced way and each and every activity like the total consumption, in which it is ensured that the consumed products are in given back in one form or the other, such that it can be used for the next level of consumption. The consumption, rather than calling it that, it can be considered as use and everything is and becomes useful, thus not allowing anything to become wasteful. Thus, it can be said that a lot of different innovative ideas to generate sustainable concepts for human settlement or human endeavors can directly be adopted from nature.

When the ecosystem is defined and classified some very critical features need to be taken into consideration, safeguarded, and understood before it can be taken further in terms of design.

So, what are those considerations, is it the type of area, in terms of area of coverage, is it the type of Geographical features that area has such as mountains, river, water bodies and understanding the topography of the area. is it a flatland or is it a sloping site? all of these aspects matter for housing that ecosystem. Then certain other aspects need to be considered such as the longitude-latitude, the location of the site, the climatic conditions, and the interaction between these Geographical features. For example, consider the climatic condition of the Western Ghats, it is the hilly region when this type of climate interacts with the tropical climate it results in heavy rainfall and flora fauna experienced in this region. Also, the next important aspect to be taken into account is the geology that is the soil structure, the earth structure, the type of soil present and understanding the type of quarrying that can be done for that type of soil, would it be safe to make the land flat, can the land be cut for development of the building, the different types of water management systems, that is the underground water, the different kind of layers of soil and strata present, if the flow of water is enabled, does the soil have percolation capacity or is it impervious. These are some of the particulars that need to be taken into consideration before proposing any kind of change. The working of the whole system needs to be understood as all these systems support a certain kind of flora and fauna. Each and every species has a role to play in the ecosystem starting from some small bacteria in the soil to a worm to a plant to seed to any kind of species of animals such as a moth or a fly, or a butterfly to the larger species of animals, only when these roles are played efficiently will it result in a more balanced ecosystem. Human beings are also a part of this balanced ecosystem. Thus, when any design changes are made for

better human comfort or need, it should be ensured that the resulting ecosystem is also equally balanced or as much balanced as it can be made. It is preferable to use the help of nature itself, as nature has a sense of rejuvenation, adaption, and accommodation of changes, it is not a static aspect. Thus, one needs to be able to appreciate what nature can do and adapt to it along with using the potential of nature to one's benefit while also maintaining the balance of the ecosystem. Hence this understanding of interdependence is very crucial to make a design sustainable.

1.4. Understanding the difference between need and greed

At the start of the design, targets are set as to how much water would be needed to provide for each of the people, how much accessibility of resources would be needed, how much facilities would be given for the people, what would be the density of the population residing in a certain given amount of land, all of these are some of the prerequisite standards and goals that are set before the start of the project. It is of utmost importance and it should be ensured that these goals are based on need and not greed. There is always luxury available to use a variety of different solutions but it should be based within the scope of need, so when different benchmarks of the lifestyle anticipated to give to the citizens of the settlement are set, it should be such that it is of a certain pattern which is sustainable, which we can avail the resources which are available in the local area, make it compatible with the type of climate and topography and the lay of the land being constructed upon. When certain income groups are considered, now this is a very interesting thing when one says income, is it about just the money that a person earns and spends or is it about the kind of lifestyle that the person is allowed to have, the main difference being the health part. Now suppose a person has a certain amount of income but spends most of it (30 to 40%) in maintaining good health that means the quality of life is so low that most of the earnings are going in maintaining health. Considering the cost of education if one wants to learn something that is the effort or the cost that he puts in ensuring that he can learn certain things and what is the availability of resources for welfare like suppose a person wants to have a backup or say insurance or something for his children as a resource and to have a backup, what are the different welfare facilities that he is going to be able to avail, or if the person was supposed to get unemployed soon what kind of fall back would he have in terms of job opportunities for the source of income. So, it can be said that welfare facilities also ensure stability in habitat such that one feels more secure living in a certain place, living in a certain community, or living in a certain society. So when the term income is talked about it's not just about the money it's also about the quality of life, having high income but no quality of life becomes of no value if it does not give anything in terms of lifestyle or social welfare. Thus for a habitat when a benchmark is set, it should be a cumulative effect of all these things, that is access to education, having good health so when the pollution is reduced automatically the types of health problems faced will reduce, the expenditure for maintaining health will reduce, have access to good food healthy food which is produced in the local area will automatically reduce the expenditure for good food and nutrition to maintain good health. If education facilities are provided in the nearby area, then access to good education good facilities of development will automatically be achieved. Hence it can be said that whatever may be the income, it is not about the money but it is about the quality of life that it can afford so it's not earning the money but it is about what kind of life one can be lead with it.

So, the benchmarks need to be set accordingly, when planning and designing for this facility as a whole for habitat that one wants to give and there should be a clear distinction between need and greed.

1.5. Perception of lifestyle

When designing aspects like the kind of facility to be given, building typology, the type of sector it would be, different ideologies for water management, need to be considered along with understanding the general perception of people in this regard. For example, consider a garbage collection point most of the people don't prefer to have it in front of their property due to the perception that it will stink, it will look ugly, and it is not something anybody would want to see every day when they come out of the house or building or flat and hence it is not something that is considered conducive for the enjoyment of a good life. The perception will change, only when there is a change in the way the garbage is collected and kept. If it is smelling good, if it looks good and if it is used as a recreational facility and it gets merged with surrounding such that people do not even notice that there is a garbage collecting point, then there would not be any problem in having it at a certain place or location. No one would object to it. It becomes of utmost importance to understand the perception of people, their aspirations, their needs, the way they want to be known in the society, the kind of respect they demand from the society, and the way the society looks at benchmarks in terms of the profession. For example, consider a cleaner



on the street, is he given respect by society, is that profession good enough to call himself a successful person? All of these also matter, so when certain services are expected it should also be seen to it that the profession is respected in the society and give dignity to the labors, and it is made in such a way that, the person feels good that he's doing that job or feels that he will be respected for doing that job. So many at times the solutions are not just about giving a service or an infrastructure but putting it in such a way that the society will accept it and respect it and the people giving that service will feel pride in doing that service. The dignity of the labor, respect from the society, acceptance from the society and going along with the hierarchies placed by the society or changing it in a natural manner is very crucial when such services of systems are made in our design and this will come from the understanding of the culture of history, of social power play, the interactions, the political setups that the society works with. There has to be a thorough understanding of these things before any kind of service or infrastructure is proposed, because otherwise it will be wasted and it will not be accepted, it will not be maintained and all the vision and effort will go waste. And finally, when people accept the design and there is a sense of ownership to the design from the people, from the stakeholders, it creates a sense of belonging and the vision comes into life or becomes a reality. So, the basic idea is whenever anything is designed it should be something that can happen in real and that can be accepted by people or rather people would own and use it as if it were their own.

1.6. Urban Development

When development is considered be it urban development or any kind of settlement development. The questions that need to be asked are where are the buildings going to be located in terms of the existing landscape, existing nature, what is it going to replace, what kind of form will it be as compared to what exists already. If suppose it is replaced what will the overall impact be, what are the things that are going to be there like trees, or will there be horticulture or will there be agriculture or there may be an existing settlement what is it doing now and what would be the impact on that settlement if it gets replaced. Would the replacement make things better or would it be the same or would it become worse? These are some of the questions that need to be thought about and answered before making the final decision. In addition to these, some other aspects that need to be thought about are, after the construction how will it be managed, what kind of waste would be generated, how the is going to be managed, how much consumption of energy would be there in terms of building it, the products, the methods that have been used the source of material that has been taken. Secondly, aspects like the energy required to maintain the facilities created, the life of the facility and if it were to be replaced with new what would happen to the old and how this new facility would be procured, the whole carbon footprint that the development will have right from seed to soil should be considered. Similarly, the services that are required to maintain the comfort, to maintain the lifestyle, to maintain facilities and services of the settlement should be thought about in terms of the cost of the services, the impact, the overall carbon footprint, the energy consumption, the kind of waste generated, before making the decisions about the facility to be given. Lastly, the question that is asked is where it is coming from? Now, whenever there is a design or shape there are multiple types of materials to choose from, a good decision would be to base the decision on understanding where the raw material came from, if say the raw material were food, then where was the food coming from? if it were water from where would the water be sourced if it were energy from where would the energy be arranged?

In this case, it becomes very important to understand the source of whatever that is consumed and different ways to maintain that resource, now if it were a natural resource how different ways need to established to recharge and maintain it for a long time, if it were a man-made resource then different ways have to be determined to produce it with minimum impact on the environment. So, everything that has been considered to be used for the development or to be provided in the development there has to be questions like 'where is it coming from?' 'how could it be provided?' 'what is its impact on the Environment?' which needs to be answered in these kinds of settlement design.

1.7. Progress towards Sustainable Design

Table 1-1 Global statistics on urbanization, energy and resource use compiled from tables published by the World Resource Institute

Source: Gerald Mills, University College Dublin_ <https://www.researchgate.net/publication/227266114> available at www.wri.org

	Developed countries	Developing countries	World
Urban population 2000 (millions)	903	1986	2890
Percent urban, 2000	76	41	47
Urban growth rate, 2000–2025	0.5	2.9	2.2
Passenger cars, 1996 (per 1000 persons)	326	15	84
Gasoline consumption, 1997 (litres per person)	626	55	182
CO ₂ emission, 1999 (tonnes per person)	10.8	1.8	3.9

The urban settlement and urban climatology, they have categorized urban population in blocks of 2000 million and it can be seen how the number of such blocks in a developing nation is more and it accounts for more than half, almost 60% of the urban population is in developing countries and if the percentage of the population living in urban areas is considered it can be seen that it's the other way round, that is the 76% of the total population of the developing countries is in urban areas. Now, what does this mean? It means that the resources from the developing countries are being utilized for feeding the urban population in the developed countries that is why these countries are able to have so much population in the urban setup. If the same pattern is followed, that is 76% of the urban population (considering the way urban is defined today) is converted into the urban population in the developing countries there are not enough resources to maintain. As shown in the above table, it is seen that the growth rate in developing countries is being pushed towards urbanization or rather a similar pattern as the developed world is being created. But looking at the consumption of passenger cars in the developed countries, for every 1000 population 326 people are using cars while in the developing countries, for every 1000 population 15 people are using cars, this indicates that the more the population is in urban setup the more is the vehicular traffic which further leads to types of infrastructure, carbon footprint, consumption of petrol, so on and so forth. Also, considering the gasoline consumption it is 626 liters per person in the developed countries compared to a mere 55 liters in the developing world. Now suppose if the developing countries were to convert their 76% of the population into urban setup, not only would they be reducing the agricultural, forest land, and the wetlands, which are producing food and resources for and is supporting that population. It would also be increasing the carbon footprint and overall consumption. So, on one hand, the production is being reduced while on the other hand, the consumption is increased. That is not a sustainable way to approach the issue. While the developing countries say that they are progressing towards a more sustainable settlement, this whole table shows that moving towards converting more and more population into an urbanized setup is not being sustainable. In fact, looking at carbon emission in 1999, it can be said that at present it surely has doubled and the carbon emission is 10 times more in developed world so if when the developing countries are moving towards the developed country, then it can be said that they are looking at consuming 10 times more than what they are doing now and are also looking at producing much less, almost 10 times less than what they are producing now. Can it be considered as a sustainable plan is the primary question here in this scenario and is that what should be put forward for developing a strategy for human settlements. When looking at the numbers above it does not make sense, so what must be done is bridge the gap between urban and rural in a much more sustainable manner and in a much better way which can be considered balanced. First of all, the developing countries should reduce giving away their resources for the urban population, the urban setup itself has to start producing resources and start managing its waste better and create a lesser carbon footprint. For a sustainable design approach, on one hand, the urban sector needs to move away from this kind of consumption while, on the other hand, the rural has to update its infrastructure so that the rural is not completely converted into an urban model, and it would help in reducing the tendency of people for migration and conversion of the population into urban pockets, rather the rural itself becomes a good place to live in while also being sustainable and the maintaining a low carbon footprint. Thus, the understanding obtained from the above chart is very simple, the more rural the countries are, the carbon emission and environmental stability better. But for the sake of aspirations of people and the type of infrastructure that is needed for the citizens, for the people there is a need to create a balance in such a way that urban infrastructure is created but not at the cost of this kind of development.

1.8. Defining Settlement Design

Finally, it is about fundamentally defining a good settlement, it can only be considered as a good settlement if it is taking care of the basic requirements of the people, like food, water, providing a sense of society or sense of community or a sense of culture. There are different aspects such as to respond to climate, soil, landform, the type of soil fertility existing at present, then the different planning and policies such as agricultural planning and development, horticulture planning and development, support from fishery, flora fauna, the forest produce and the land produce needs to be considered to



achieve good food lifestyle. The first stage is about understanding how up to a maximum level the context can be utilized to satisfy the requirement of food in a balanced manner. The second stage is all about water. Now food and water come almost parallels because without water there is no food, without the support facility of water management it is difficult to assume that one will have food that is required. Thus, the criteria remain the same like soil, climate, landform, water bodies, agriculture, horticulture, but in this stage another aspect is added that is the lifestyle, how much of waste is being collected, how much of pollution is being created due to lack of waste management, resource management also becomes important along with kind of products that gets into the water, all of these also become equally necessary for good water management. The last aspect being the society along with the climate, landform, agriculture the type of food, flora, and fauna all of which influence in terms of the culture, in terms of food habits, in terms of maintaining the comfort condition and in terms of a lifestyle. Apart from the above aspects the history of how things have evolved and how events have influenced the daily practices, the belief system, and way of relating to natural elements, all these paradigms will also affect the way a good settlement is defined. So overall, this kind of understanding of a place can fundamentally define what is a sustainable settlement for that particular context for that particular place for that set of people for that specific culture.

2. Literature Study

Over the last many years, the world has become more aware of the environmental issues and the overall sustainability in settlement development, in the lifestyle of people, in using the different construction methods. Sustainable development should also focus on providing better living and working conditions for the poor, along with providing them affordable access to housing, health care, water, sanitation, and electricity. (Towards Sustainable Cities, World Economic and Social Survey, 2013).

Sustainability can be defined in many ways, one of the broad ways of saying would be that which meets the need of the present generation while also ensuring that the future generation is left with sufficient resources. Sustainable development constitutes 3 major dimensions – economic, environmental, and social along with other aspects like health care and technology. Presently the idea of sustainability has become so popular around the world that it is considered as a potential solution for many issues faced at international, regional, and local levels by society such as overpopulation, diseases, political conflicts, pollution, infrastructure deterioration, and unlimited urban expansion under limited resources. (Jovovic, R., Draskovic, M., Delibasic, M., Jovovic, M., 2017).

2.1. A framework for sustainable cities:

It has been proposed that the building of a green city is equivalent to building a sustainable city. (Beatley, ed., 2012). Many countries are developing green cities also called eco-cities as a starting point for developing sustainable planning. But it is very important to understand that the sustainability of the city does not only dependent on green buildings but also depends on social development, economic development, environmental management, and urban governance, it refers to the investment and management decisions taken by the local municipal authority. (Towards Sustainable Cities, World Economic and Social Survey, 2013).

It can be said that to achieve sustainability in the cities, the integration of the four pillars – social development, economic development, environmental management, and urban governance play a very important role.

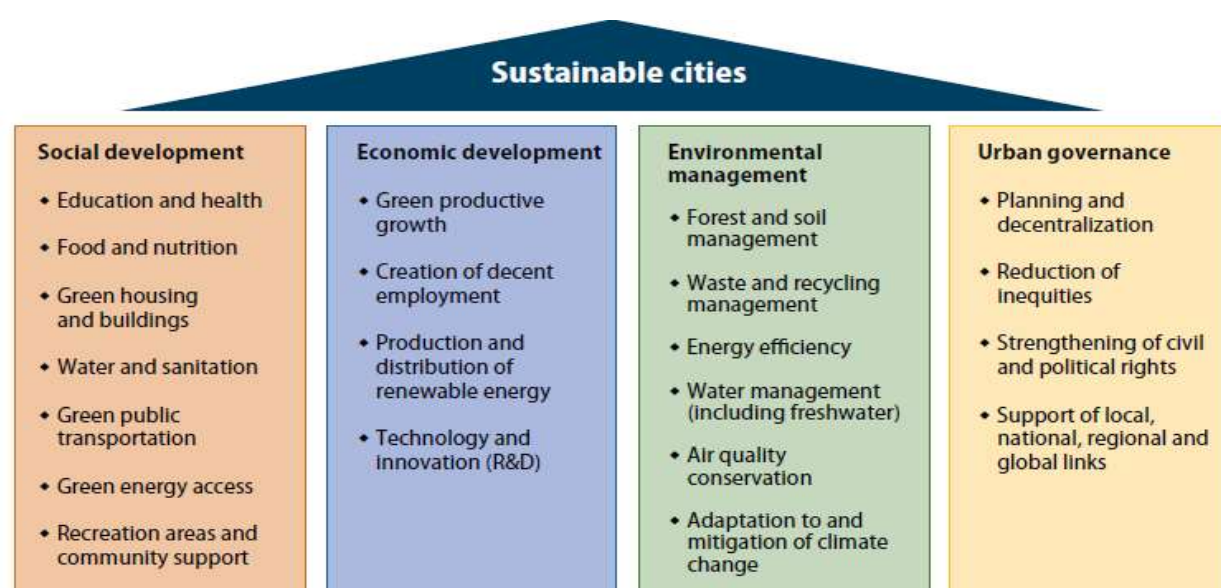


Figure 2-1: Pillars for achieving sustainability of cities

Source: UN/DESA, Development Policy, and Analysis Division

The notion of sustainable development is considered development when both economic and environmental goals are used along with the use of sustainable construction techniques for better agricultural production, energy use management, natural resource management, and industrial production. There are different approaches to understanding the aspects on which sustainable planning is dependent. One of which as suggested by the author, (Munasinghe, in Pearce, 1999) is that the concept of sustainability depends on only the three major aspects i.e. economic concepts, environment, and social these are based on aspects of integrated community development in the regional areas which also include healthcare systems, technology, recreational, and culture. When considering settlement development only these three concepts can be considered unlike the four pillars mentioned above for regional level city planning. Implementing the above three concepts of economic, environment, and social on a regional level requires the numerous amount of planning and policies and it would become rather difficult to integrate these on a regional level as the implementation and coordinated action in different areas should be such that any achievement in economic growth also helps in achieving the social objectives without endangering the resources of the planet.



The above three classes of issues can be arranged in a triangular format explaining their interdependency through Munasinghe's Triangle. (Munasinghe, in Pearce, 1999). Sustainability involves finding solutions for the above three aspects in such a way that all the impact is balanced. (Jovovic, R., Draskovic, M., Delibasic, M., Jovovic, M., 2017).

Under the Economic aspects of the issue, major points to be considered are the efficiency, growth, and stability while in the environmental aspect, biodiversity, natural resources, and pollution are considered and social aspects poverty, empowerment, culture, and heritage are to be considered.

Another way of perusing the inter-connection or interrelation between the above three aspects: environment, economic and social can be expressed through Daly's Triangle which replaces the social aspect from Munasinghe's approach with equity and considers the three main aspects to be equity, economy, and

environment. These aspects can be arranged in a triangular format with the environment being the most primary and occupies the bottom of the triangle followed by the economy which occupies the center of the triangle and the top of the triangle which is occupied by equity.

The natural environment is considered as 'ultimate means', economy, technology, ethics, political is considered as 'intermediate mean' while equity, human wellbeing, is considered as the ultimate ends' in this triangle, designed according to Daly's triangle. In this the intermediate mean that is the economy is placed at the center of the triangle so that when economy succeeds it achieves the ultimate end that is it achieves the equity and human well-being and when the economy is conserved and protected this results in ultimate meaning that is the conservation of the natural environment.

The three aspects of sustainability from Munasinghe's approach, the economy, society, and environment can be considered as three eccentric circles where the economy is placed within society and society and economy both are placed within the environment. One can achieve sustainable development or a sustainable settlement only when measures and policies are taken such that all three interconnected aspects are equally respected.

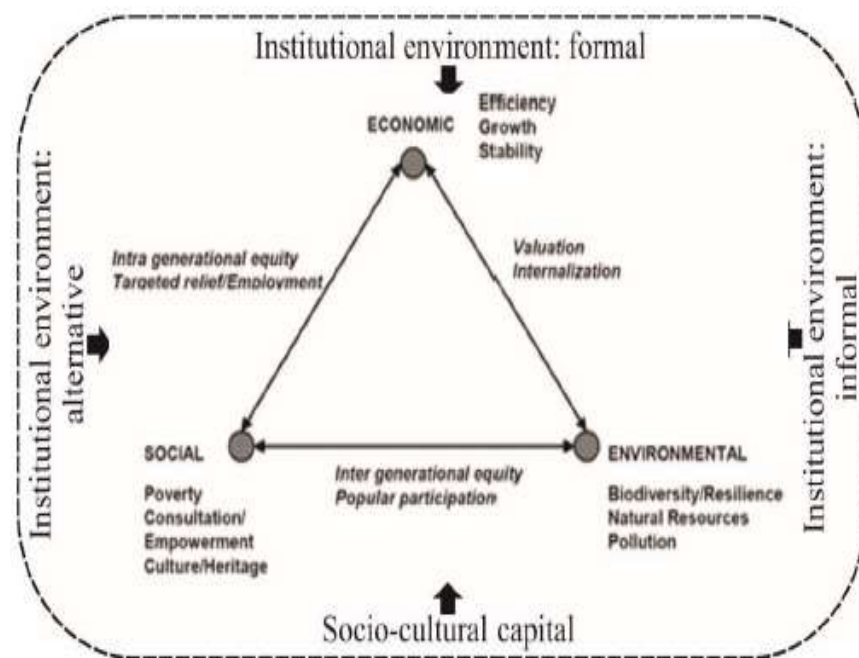


Figure 2-2 Munasinghe's Approach to Sustainable Development
Source: Adapted to Pearce, 1999.

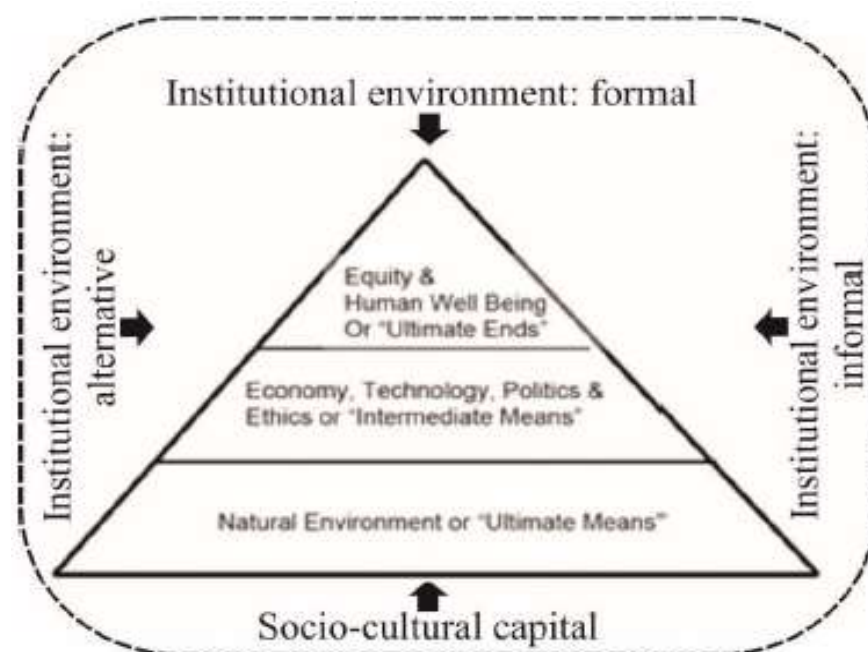


Figure 2-3: Daly's Triangle of Equity, Economy, and Environment

Source: Adapted:

Source: www.sustainablesociety.org/keyconcepts/dalystriangle.html

2.2. Institutional Components and Sustainable Regional Development:

Understanding the institutional components of regional development also plays a major role in achieving Sustainable Regional Development. The following are the six sub-systems showing the interconnections between each other. Each of these sub-systems to be viewed as representing a certain type of potential that is vital to the overall development of the total system. (Bosel, 1999; Shuaibu & Oladayo 2016).

The above figure, first depicted by H. Bosel explains the sustainable settlement through an institutional system, considering it to be an important aspect of sustainable development on the global and local levels. (Langeweg, Hilderink & Maas, 2000)

Sustainable Development can also be approached through a central objective which would be to decouple the conventional use of resources with the economic development of the city using various technological innovations, improved efficiency, and changes in individual practices.

As the global urbanization is increasing and the human activity is getting more concentrated in the urban areas, efficient settlement planning becomes the key feature of sustainability planning, the inclusion of environmental aspects in the planning along with understanding the urban climate can help develop efficient planning strategies.

Even though there have been lots of research conducted concerning the relation of climatology with urban settlements, but there has not been generated such an applied climatology that establishes a link between design decisions and climatic outcomes. (G. Mills, 2005).

2.3. Understanding various approaches considered by different countries towards designing sustainable settlements:

To better understand the different ways in which sustainable development settlement can be planned, extracts can be taken from different existing case studies, from both foreign and Indian contexts.

The author (Bulcent Acma, 2005) explains the different concepts of promoting human settlements and eco-city planning approach in the GAP project in Turkey. Anatolia receives less precipitation compared to the other regions of the country, the idea was to utilize this rich water potential for energy generation and irrigation and regular the flow of the rivers (Unver, 1999). This integrated project does not just cover the multipurpose dam and irrigation schemes but also looks into the development in related areas of agriculture, energy, transportation, telecommunication, health, education, and urban planning. The basic development idea of the GAP masterplan was to transform the region so that it acted as a base for agro-industrial products. (Bulcent Acma, 2005, GAP Master Plan, 2002).

This plan also observed the principles of sustainability. While supporting the socio-economic adaptation and resettlement. The eco-city planning criteria were applied in all aspects such as biodiversity, analyzing climatic features, wildlife projects, environmental health awareness projects, social components, the economic component, spatial component, and related activities along with proposing various government strategies and policies.

The types of construction materials and traditional design techniques used also play a very important role in developing a sustainable settlement design.

Considering two different climate cities of Iran, authors (I. Khajehzadeh, B. Vale, F. Yavari, 2016) discuss in their paper the different traditional materials and techniques used in the ancient times to survive the hot and dry and hot and humid climate of Yazd and Bushehr cities respectively.

Both the houses were typical central court houses, with mud-plastered walls, the brick obtained from the same land where the houses are being constructed. No windows towards the exterior walls to avoid direct hot breeze from the outside environment. Wind catchers designed on the southern side of the house to allow a cool breeze into the house during hot summers. Single or Double storied houses. While the Bushehr house is normal double-storied, sometimes also supporting

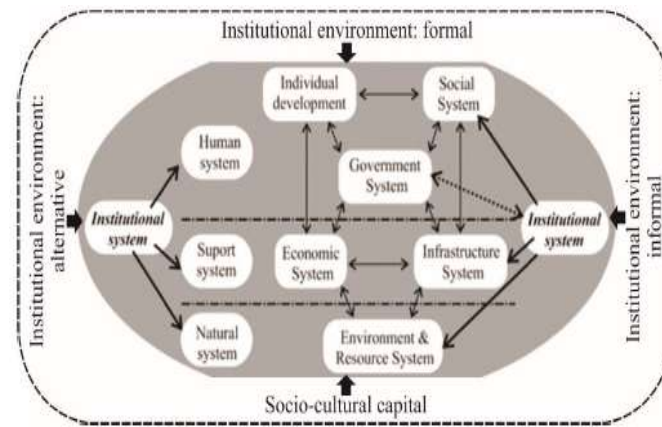


Figure 2-4: The six major systems of the anthroposphere and their major relationships

Source: Adapted: Bosel, 1999

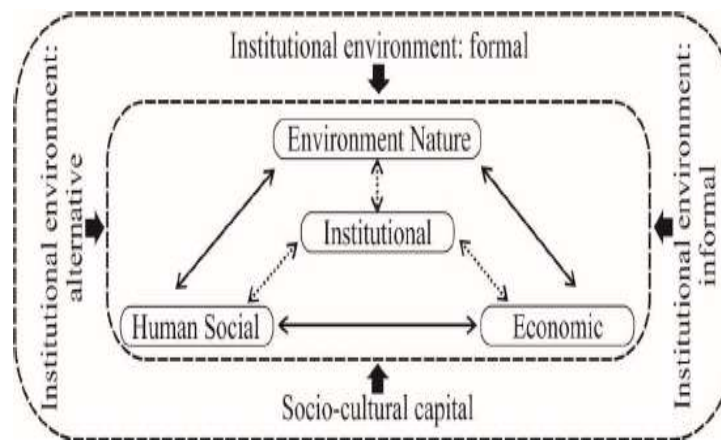


Figure 2-5 Characterization of sustainable development: the interaction between economic, environmental, human and institutional domains

Source: Adapted: Langeweg, Hilderink & Maas, 2000



three floors, with high walls to allow more shadow as the temperature can go high during the summer. The central courtyard is a square and mostly regarded towards the north.

These are some of the design techniques that could be used in the Indian context with similar climatic conditions. These traditional and passive techniques also help approach the settlement design pattern more sustainably and efficiently.

When discussing building materials, thought could also be given to the green development in the Slovak Republic, where they are trying to achieve sustainability only using the ecological materials available in their locality. (M. Moresová, M. Sedliaciková, J. Schmidtová and I. Hajdúchová, 2020).

This method though not popularized yet between the locals, a few younger generations have started building their houses using ecological materials like wood, bamboo, reed, straw, and clay, while avoiding the use of brick masonry for construction.

The use of ecological materials has started becoming more popular in the town area where the carbon footprint is already high due to different large industries, and people do not want to add to that carbon footprint by further constructing even their houses using masonry.

But in rural areas, these materials are yet to be as much popular. People are reluctant to construct using wood and bamboo as it does not have higher fire resistance and it requires trained labors along with a sufficient economy.

If these building materials are promoted and people are educated about the availability of the material, it could be widely used in both rural and urban areas.

When proposing a newer efficient Sustainable settlement planning, certain different aspects can be taken from the traditional Indian and Arab sustainable planning techniques, as mentioned by authors (M. Dhingra, S. Chattopadhyay, 2016).

The physical form of the cities is measured in terms of distribution and density. Urban forms are all about – Building aspects, skylines, city boundaries, social groups, and special markings.

While cities in Arab gave in to the urban globalization and started constructing a tower-like tall structure, come of the cities in Rajasthan have still maintained their traditional aspect of planning through this globalization.

In Arab, the traditional residential planning in a settlement was a courtyard type plan with opening placed onto the inner side of the courtyard, the orientation of the houses was away from the direction of the sun, prominent wind towers, use narrow streets as private street corridors. While in Alwar, Rajasthan the traditional residential planning was of the 'Moholla' type planning, which included a cluster of residences throughout the settlement separated by narrow roads and open spaces, religious spaces along with Chaukas designed near the intersection as public gathering spaces. This kind of organic growth pattern created a sense of visual linkage to the Aravali hills.

The planning strategies in Alwar involved, multifunctional with courtyard centrally placed, fenestrations, and open spaces in the form of jallis and balconies, oriented and tilted sideways to avoid direct sunlight. The overall accessibility was provided using narrow walkways and alleys, and street corridors for kids to play. These traditional settlements show a holistic approach to building technologies that were sustainable and environmentally friendly.

All these aspects can be used in the present settlement planning for efficient design development.

In the modern-day urbanization process, the streets are losing their diverse traditional touch and moving towards homogeny in terms of commercial shops, material, building construction, and is slowly being transformed into a more modern style, especially through modern material of façade design (glass and concrete). One such example as explained by the authors (A.B Sholihaha, T. Heath, 2016) is Pasar Baru Street in Indonesia, a complete traditional street that transformed into the modern street due to urbanization.

Therefore, when developing a settlement design strategy, it should be seen to it that the existing streets do not lose the traditional touch in terms of function, sense, and visual quality maintaining the diverse and ethnic style within the streets thus improving the quality of streets and the urban space around it.

2.4. Sustainable Settlement Planning in Indian Context:

The above discussed were the different ideologies and strategies about sustainable settlement planning taken from the foreign case studies and perspective, these can be modified and developed further to suit the Indian context.

Now, what does Sustainable settlement planning mean in an Indian context and principles? According to the author (Dhiru Thadani, 2011), who tried to understand the famous statement by Mahatma Gandhi "The future of India lies in its village". Gandhi believed that it was impractical for Indian cities to accommodate the ever-increasing population efficiently. The

villages in India were self-sufficient, simple, free, non-violent, and truthful. Thus, he suggested that the Rural part of India could be provided with enough services in all aspects so that the people did not migrate to Urban areas and overpopulate the same. In this manner, India would have a well-balanced both Rural and Urban area. He suggested that robust community life is essential in the rural village as it is in any other urban neighborhood, the building block of a successful city.

Vice President Shri. Naidu said that approach to development must have a dual focus, it must be comprehensive and must keep both the urban and rural ideologies in view. He also agreed with the principles of Mahatma Gandhi and proposes that more development of services and infrastructure should be considered in rural areas as well, to avoid migration to urban areas as those are already congested and have a very large carbon footprint. The traditional aspects, arts and crafts, skills of the village should be utilized as a part of the development. He also pointed towards the main aspects that need focus are – a clean source of energy, reduction in consumption, and efficient waste management. (Development of villages is an essential precondition to development of the nation: Speech by VP at the AICTE Awards Ceremony, 2019).

2.5. Understanding the Concept of Smart Villages in India:

The increasing population of the world makes it necessary to alleviate the cities and the villages to serve smartly. (Dr.C. Grace Indira, V. Anupama, 2015).

In this present era, development is needed for rural and urban areas to maintain balance. The concept of smart villages can be obtained through first establishing the vision and need, different approaches, government policies, and technology. It is also dependent on the local condition, infrastructure, and available resources in the rural area. Urbanization up to a certain extent cannot be stopped but it is always important to maintain a balance between rural and urban development.

The various approach towards smart villages considered are as follows:

Community mobilizing

Converging government schemes and private initiations

Partnership development

Life cycle approach

Protecting the local culture and tradition

Technology development

With this kind of development in the village area, the migration from the rural to urban can be avoided thus reducing the clustering in the urban region.

2.6. Understanding the relationship between Streets and Sustainable Settlement:

In a settlement planning, the design of streets also plays a major role, it becomes important to understand how these streets have been designed in terms of commercial aspects, built and unbuilt spaces.

Foam based coding (FBC) is a way of regulating land use development to achieve a particular type of landform. According to the authors (L.S Shajia, M.K Kini, 2016), the following are the aspects that can be obtained from FBC considered through a case study of a commercial street in Kerala:

Each stop in the street will have its own commercial area Corner plots to imbibe a pocket area to attract people Neighboring shops can share a common veranda space if they share a common wall Segregation of shops from the main road to the collector to avoid congestion at a one single area Maintain a sense of history, use of material such that it depicts the cultural through material and form Build height to street width ratio to be maintained Built to unbuilt space ratio, such that the scale and character is maintained The same aspects can also be applied to streets in settlement design to obtain a more sustainable and efficient development plan.

2.7. Vastu Shastra in Sustainable Town Planning:

In India, a lot of importance is given to Vastu and people believe and follow these traditional planning principles in most of the building design strategies. Respecting the beliefs of people, the principles of Vastu can also be used for a sustainable town-planning design. (Reena Patra, 2014). For sustainable town planning concepts of Purusharatha i.e. Dharma, Artha, Kama, and Moksha along with Vastu Purusha Mandala are implemented.

As mentioned in the Vedas, man can improve the condition of a site by understanding its location, direction, deposition.

The fundamental principles of Vastu Shastra are:

The doctrine of orientation: the cardinal points

Site planning: soil, size, shape, colour of site



Proportionate measurement of Building

Six cannons of Vedic Architecture

Aesthetics

The following points are to be considered when implementing Vastu in town planning;

The site should be lowered on the east side to allow direct sunlight, natural scenery should be such that it adds to the beauty and grandeur of the place, any site should be avoided on the western side of the mountain, avoid southerly exposure or tilts, it is preferred to have water bodies on sites such as lake, river, pond or tanks. The roads running from East to West – allow circulation of sunlight through the day, and roads North to South – circulates cool breeze throughout the day.

Vastu Shastra also describes the location of different buildings such as the admin complex, schools/universities, industries, residences, commercial shops, and cremation ground within the town. (Reena Patra, 2014 and Ancient Settlements in Literature-Article).

2.8. Sustainability and Livability in Settlement Design:

The other aspect to be considered in a settlement development is the relationship between sustainability, livability, and settlement planning.

Settlement plays an important role in creating human civilization by providing space to meet the present and future needs. Overtime the occupation and activities of human change and thus the environment provided should be able to adjust to the change and in turn, the inhabitants have better living conditions to achieve sustainability. (Thorsby, 2006; Leby J, L Hashin, A, H, 2010). Livability here is mentioned as the rating of happiness or something that provides the external opportunity or improves the quality of life. It can also be explained as an ideal condition where a settlement or city can adapt to create an enjoyable life to maintain and even improve the quality of life. This improvement in the quality of life will further lead the inhabitants to develop a sustainable city. Therefore, it can be said that livability on a settlement is a process that would integrate the various aspects of the life of its inhabitants. (P. Setijanti, I. Defiana, W. Setyawan, J. Silas, S. Firmaningtyas, and R. Ernawati. 2014). Livability is the implementation of sustainability in the context of the local community.

2.9. Understanding the importance of Resilience in cities:

When discussing the development of the cities, different types of shocks and stress impact the city in different ways. Their levels at present are increasing at an alarming rate due to rapid urbanization, climate change, and political instability. One such aspect that can help in reducing these effects is by designing resilience cities. Resilience refers to the ability of the urban system to maintain continuity through the different shocks and stress. The approach towards designing a resilient city is to have different access plans, policies, and acts while preparing itself to face different challenges. (Resilience Cities_UN-Habitat)

Natural disasters to date have caused huge losses in terms of humanity, resources loss, thus damaging the economy of the country. The concept of resilience cities increases the capacity and decrease the fragility of the city.

The different resilience strategies as per UN-Habitat that can be incorporated in cities are:

- provide knowledge about the best practices by gathering information from the local body
- advocating the different strategies and activity through campaign and promotions
- collaborating and partnering with a private corporation

These strategies not only help in developing a resilient city but also help in developing a sustainable settlement and city. The overall literature study has given an idea about the different approaches in terms of planning of buildings, streets, use of different local building material, use of different government policies and strategies to develop a sustainable settlement plan, which also retains the local traditions and culture along with an aim to improvise the quality of life of the people living in the settlement.

3. Structure of study

Four pillars of sustainability defined through literature and Indian ethos is that the design should respond to context and context is defined in four pillars.

1. Natural Setting- Kestra- natural setting including geography, climate, flora, fauna etc. Understanding ground water, hydrology, geology, geo morphology, water catchment, drainage pattern, slope analysis, bio diversity et chance knowing the natural resources and ecological cycles of the region.
2. History and Heritage- Loka- paradigm of the place, a construct of settlement developed through time and historic events. This gives the key events and importance of various structures and practices in history. Understanding the perception and beliefs of the society. Respecting the local know how and culture of the place.
3. Socio-economic-political structure- Desa- the socio-economic and political context for governance, mortality, human development index, demographics, occupation etc. Trends, aspirations, lifestyle of people. Immigration and migration of people and the reasons.
4. Physical Infrastructure- Sthana- Mana- the current status of the place w.r.t. to physical infrastructure, social and cultural facilities, water sources, social infrastructure for health, education, transportation etc.
5. Planning concept and structure- Bindu and Cakra- developing overall benchmarking for people, addressing critical factors of the region, development criteria and best practices, circular economy, sustainable practices, management of resources, waste management, good governance etc.
6. Physical development plans and policies- final landuse and development plan with policies and guidelines for physical infrastructure, conservation of resources, circular economy for waste, sustainable industries and building guidelines, recommended guidelines for waste, and future developments etc. and demonstrated in projects.

3.1 Survey Procedure and Approach Strategies:



- The saved Entry can be completed by accessing the Continue Previous Tab.
- The form can be sent after completion.
- Geo tagging has to be done under the open sky.
- The information required for the app is quite limited as compared to the survey form
- The app is functioning smoothly, and no other issues are identified so far.

3.2 Survey Approach Strategies:

Take sample from each ward and each community, profession, age group, as much as possible. Geo tag water sources, social infrastructure and landmarks etc. Identify local volunteers and handhold them and train them for the app. Do ground survey ward wise ourselves with the volunteers. Collect Phone numbers of People at random. Circulate Hard copy survey forms in Kannada for the others and ask volunteers to continue the survey. This way we can complete most of data collection off site. Challenge would be to keep track of Geo tagging for the App

Do on site observations and take soil and water samples.

3.3 Process and Timeline followed for Gram Panchayat Spatial Development Plan

WEEK- 1:

A brief overview of GPSDP proposal by MoPR, SISDP presentation by GOI-MoPR.

First virtual meeting on Gram Panchayat Spatial Development Plan for rural areas was held through video conferencing on 1st July 2020 where the Secretary, Ministry of Panchayati Raj made introductory remarks regarding the vision of the gram panchayat special planning project (Figure-3.1). The NIC National Informatics center made a presentation on the Gram Manchitra application for GIS explaining the features and the functionalities available in there. The NRSC (National Remote Sensing Centre) demonstrated the Bhuvan platform for GIS. It was



Figure 3.1 Virtual Meeting with MoPR
Source: GP Survey Group, MSAP



briefed that the aim of the spatial planning proposal should stimulate the decentralized model of development taking into account the local sensitivity of the people, their visions and their expectation striving towards Atma Nirbhar Bharat.

WEEK- 2:

Distribution of work in teams & listing of data to procure from GPs for GPSDP proposal.

The principal investigator Dr. Deepika Shetty, Director, Manipal School of Architecture and Planning (MSAP), briefed the team about the Concept Note and the criteria for selection of Gram Panchayats Uppunda and Shankar Narayana in lines with the criteria given by MoPR and Vision Document of Udupi 2025 (Figure 3.2).

Three teams were formed comprising of MSAP Faculties with three principal aspects:

TEAM-1: Socio, Economic and Morphology,

TEAM-2: Environment and Natural Resources and

TEAM-3: Physical Infrastructure.

The related information and the data that was needed to be collected from Gram Panchayat offices were listed out. In brief, land utilization index, resource mapping, land value, socio-economic structure, vulnerability index, Development Plan guidelines, policies, decision-making tools, assessment and monitoring guidelines for supporting documents were listed out to initiate the data procurement process.



Figure 3.2 Work division and discussion on project related data procurement.

Source: GP Survey Group, MSAP

WEEK- 3:

Preparation of checklist for GP data collection for both GPs by respective teams.

A preliminary set of questionnaires were framed by each team with respect to their study aspects for both the gram panchayats. The list of questionnaire included the occupation (service, job, industrial labor), land holding, housing (built up details), services, monthly expenses, health facilities, food supply, seasonal variation, various Government Health Schemes, Vocational Training, presence of Self-Group Organizations any schemes availed under SHG, issues related to water supply, sanitation, electricity and telecommunications services.

In addition to this, questionnaires should include suggestions asking for improvement of the village in terms of infrastructure for social facilities, educational facilities, healthcare facilities, business facilities, employment facilities etc.

WEEK- 4:

Development of existing land use map by GIS team for GPs

(Source: Bhuvan Panchayat 3.0).

Geographical data of shortlisted Gram Panchayat as directed by Sri Uday Kumar DDG, were provided in layers for an area around 5 kilometer of the specified Panchayat boundary which included road, railway line, Canal line, Canal polygon, river line and polygon, settlement (built up), water body, Panchayat boundary.

The progress of review of the initiative taken by team MSAP was presented by the principal investigator Dr. Deepika Shetty during the Progress Review meeting by respective institutions (Figure 3.3). The Inception Report for both GPs was mailed to MoPR.

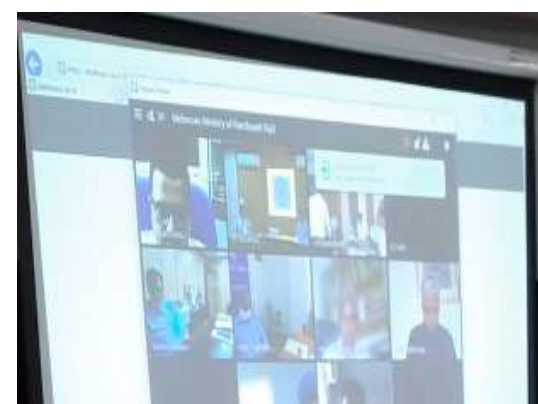


Figure 3.3 Progress Review for institutions (Presentation by Team MSAP)

Source: GP Survey Group, MSAP

WEEK- 5:

Consideration of TCPA & PR acts to implement in the study checklist.

(As suggested MoPR).

Each team reframed the set of questionnaires for the Field Survey with reference to the Rural Spatial Planning Policy issues under Town and Country Planning Act and Panchayati Raj Act. Various Government Schemes were considered for understanding the policies and schemes from the Ministry of Rural Development like Water Conservation stories, Sabki Yojana Sabka Vikas, Gram Swaraj Abhiyan, Disha, Mission Antyodaya MGNREGA, PMAY- G, Swachh Gram etc. The list of attributes to be collected in field documentation was enlisted and shared with NRSC for developing the smartphone based mobile application for the field survey and data collection (Figure 3.4).



Figure 3.4 Documentation of attributes for field survey and data collection.

Source: GP Survey Group, MSAP

WEEK- 6 and 7:

Documentation of 6 layers generated by NRSC in the study list related to Infrastructure.

The 6 layers generated by NRSC (LULC, Slope, drainage, Settlement, rail and road) through discussions held on 04 August 2020, was added in the study list and analyzed by respective teams. High quality and sustainable human settlements focus area such as Resource optimization, facility development, sustainable tourism, context specific neighborhood, etc. have been broadly identified by team as the key issues for the development proposal.

Action Plan on methodology, benchmarking and best practices were framed by respective for the broad issues identified by them. GIS team had created QGIS files and generated CAD files (layer wise).

WEEK- 8 and 9:

Demonstration on the application of Mobile App by NRSC and Timeline of activities for the Survey was planned Team MSAP.

NRSC under the guidance of Joint Secretary (Fiscal Devolution) Sh. Kushwant Singh Sethi, had demonstrated the mobile app for geo- spatial household survey considering the aspects which are shared by various institutions to be updated in the mobile app (Figure 3.5). The User Manual was shared by NRSC to all departments and a demo survey was conducted on 25 August 2020, after the credentials were shared.

The observation checklists under each broad topic were enlisted by respective teams and was shared with the survey team for the conduct of Household Survey. The survey form questionnaires were translated in Kannada language along with English transcript for the village people and the GP local volunteers for the smooth conduct of the survey.

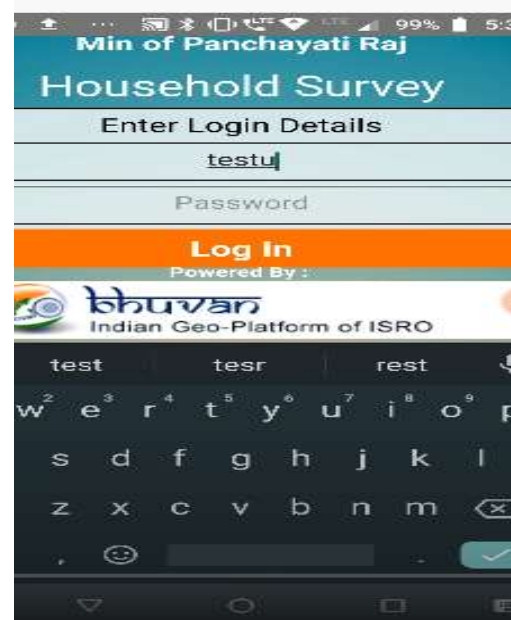


Figure 3.5 Mobile App demonstration by NRSC for Household survey.

Source: GP Survey Group, MSAP

The data needed by various Government authorities were enlisted and official letters were sent to the concerned authorities. The survey team (MSAP faculties with student volunteers) was briefed about the survey intent and process. For each GP, the team was divided as such that they shall be able to collect the relevant data and information pertaining to the issues identified for both GPs. In addition, the respective GPs were requested to allocate Local Volunteers to assist the Survey team. The application of Mobile App was re-tested again before the commencement of the survey. The following layers were received from NRSC namely, contour, geo-morphology, lithology, soils, satellite data.

WEEK- 9:

Onsite field Visit for Project briefing to the Gram panchayat officials.

The onsite visit was scheduled on 29 and 30 August 2020, firstly with the Gram panchayat officials briefing them about the development proposal. The reason for selection of their GPs was briefed by principal investigator Prof. Deepika Shetty with a formal interaction with the officials. The local volunteers were briefed about the Mobile App application by Team MSAP.



In the afternoon Uppunda GP was visited by the team where they were also briefed about the proposal and the related support needed from their side. The volunteers were also briefed about the survey strategies since the area and the number of wards were more in Uppunda.

The GP had shared their current Village Action plan which was helpful in analyzing the existing schemes and policies for the current situational analysis of Uppunda.

Few major public buildings in the GP was documented on the same day.

The PDO of Uppunda briefed about the issues and challenges faced by the Gram panchayat by the fishermen community who were the major population of the village.



Figure 3.6 Uppunda GP Officials with local volunteers and Team MSAP.

Source: GP Survey Group, MSAP

WEEK- 9 and 10:

Onsite field Visit to Gram Panchayats for household surveys and identifying issues and challenges faced by the GPs.

For generating action plan, as instructed by NRSC, the water bodies and water- resources, soil condition and soil samples, rain water harvesting methods (if any), agricultural farmland descriptions (crop types) etc. were required to be compulsorily documented with geo-tagging. The Team: Environment and Natural Resources, collected the samples of Water sources, soil types from different wards for testing and analysis (Figure 3.7). The physical Infrastructure team were working on the household survey and discussing the challenges and issues faced by the village people in terms of basic amenities or facilities for their livelihood, health and education (Figure 3.8). All the contextual information (existing roads, wards boundaries, existing social infrastructures, land holding areas, water bodies, major canals etc.) were marked on the land use maps (Figure 3.9).

The major issues to be identified in both the GPs as shared by NRSC team were documented by the Survey team which were as follows:

Water resources: Existing drinking water scheme, Sources of water and whether it is perennial, Village bore well, dug wells (geo tagged locations of few), quality of water in them, status during summer, what depth usually the water is available in them. Existing water harvesting structures, Irrigation types and approximate area under them. Agricultural resources (Dominant crops, plantation types, how many crops taken, Fodder crops etc.). Assets: Mandi, market, schools, anganwadis, Primary health centers, agro based industries, storage facilities, warehouses, etc. Soil types: broad type color and texture. Issues and aspirations of the people for a better livelihood and quality of living.



Figure 3.7 Collecting Soil and Water samples for Testing

Source: GP Survey Group, MSAP



Figure 3.8 Household survey (Ward-wise)

Source: GP Survey Group, MSAP



Figure 3.9 Documenting existing Infrastructure

Source: GP Survey Group, MSAP

UPPUNDA GRAM PANCHAYAT – TOTAL NO. OF HOUSEHOLD SURVEY

WARD NUMBER	TOTAL NO. OF HOUSEHOLD SURVEY
WARD 1	160 HOUSES
WARD 2	35 HOUSES
WARD 3	30 HOUSES

WARD 4	40 HOUSES
WARD 5	82 HOUSES
WARD 6	23 HOUSES
WARD 7	29 HOUSES
WARD 8 AND 10	23 HOUSES
WARD 9	10 HOUSES
TOTAL	432 HOUSES

WEEK- 11:

Progressive brief Presentation to Ministry of Panchayat Raj:

The progress brief meeting about the Development Proposal with Ministry of Panchayat Raj was scheduled by Team MSAP on 09 September 2020, to update about the work process. Panchayat Raj Secretary Uma Mahadevan, Commissioner Priyanka Mary Francis and ISRO coordinator Sudha Ravindran were briefed about the plan of action and the key challenges and issues identified during the survey.

Their recommendations and suggestions were documented and included for further refinement in the strategies for the Proposal.

Meeting with NRSC for work progress of Spatial Planning Proposal by all Institutions.

The VC meeting with NRSC officials held on 12 September 2020, to discuss the progress of Spatial Planning Study by respective institutions was conducted through virtual conferencing (Figure 3.10). The principal investigator Prof. Deepika Shetty briefed about the needs and concerns of both GPs, vulnerable areas of Uppunda GP, violation of CRZ rules, flooding impacts in Shankar Narayana GP where she explained that each GPs have their distinct characteristics and both of them need interventions with skills and waste management being significant in both GPs. The major recommendations by Secretary were marked for inclusion in Development Proposal which were as follows:

Focus on policy implications in Report which lay down the work of GPs, State Govt and GOI for GP Development Plan with focus on strong methodology to give a quality report. Consider the best use of benefits of existing infrastructures, locational advantages can be built in their geographical context.

- Issue of jobs is a nationwide issue to be addressed (whether rural or urban)- address the youth unemployment of graduates. GPs where electricity is inadequate, households need to be virtually self-reliant by using renewable sources like solar and also if possible return the excess energy to grid to get benefits. Propose possible solutions to the areas where encroachment is an issue to meet the standard road width. Solid and liquid waste management solutions under Swach Bharat Gramin, Phase -2. Also address water logging issues which is seen in certain GPs.
- Focus on involving villagers as equal partners of development proposals. GPs should be the drivers of economic growth, they should be a part of ecosystem where water supply, sanitation services should be par with quality benchmark of services as good as in cities. Proposal should fulfil the aspirations of people which they should determine for themselves.

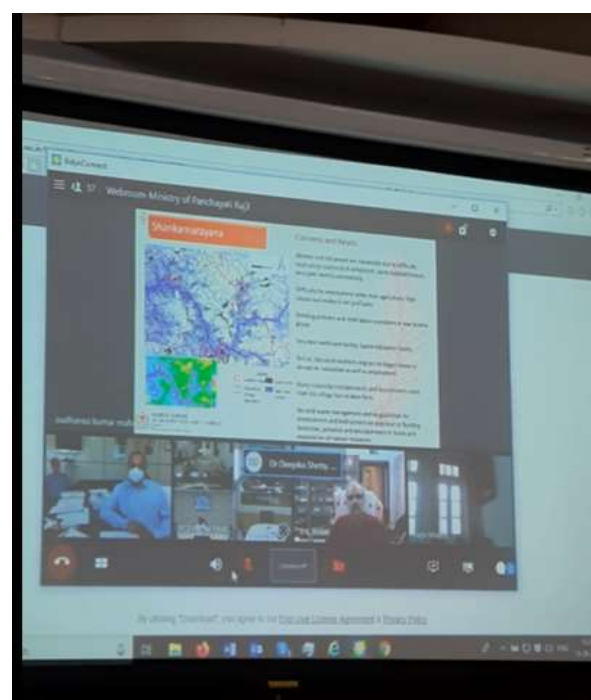


Figure 3.10 VC meeting with NRSC

Source: GP Survey Group, MSAP



WEEK- 12:

Revisit to GPs to collect survey forms and discuss on analysis done by Team MSAP with GP officials.

The Team MSAP re-visited the GP on 18 September 2020, with their analysis and discussed with stakeholders and GP officials about them (Figure 3.11). The key challenges with respect to job opportunities, livelihood income during non-working seasons, lack of infrastructure and potentials for skill development opportunities, waste management challenges etc. were the key concerns which have been raised by both the GPs which needed an immediate attention in the development proposal.



Figure 3.11 Meeting with Stakeholders and GP officials.

Source: GP Survey Group, MSAP

WEEK- 13 - 19:

Data Analysis: Existing Policy as per Govt. schemes, Understanding of local Practices in both GPs and Proposed development for GPs.

The major concerns were analyzed by Team MSAP pertaining to both GPs and the development proposal was focused on these major key aspects (Figure 3.12). All the policies related to each aspect with its best practices were included in the development plan with recommendations. It was analyzed that Land use management (different criteria's) should be different for both the gram panchayats. Recommendations for built form, guidelines for built form, ghat section (coastal areas) should be generated analyzing the base situation.

Figure 3.13 Stakeholders Meeting with GP.

Source: GP Survey Group, MSAP

Key Issues to be addressed for Uppunda GP:

1. Coastal zone protection management
2. Solid waste management (newly proposed)
3. Health and education sector
4. Road infrastructure management (road access and road system)
5. Skill development
6. Water management

This was presented on 1st Oct 2020 to Karnataka coordinator Ms Priyanka Mary Francis, Director MoPR, Karnataka and her team, Ms Preeti Gehlot, CEO, Zilla Panchayat, Udupi District and her team, Ms Sudha Ravindran, ISRO, Bangalore and her team.

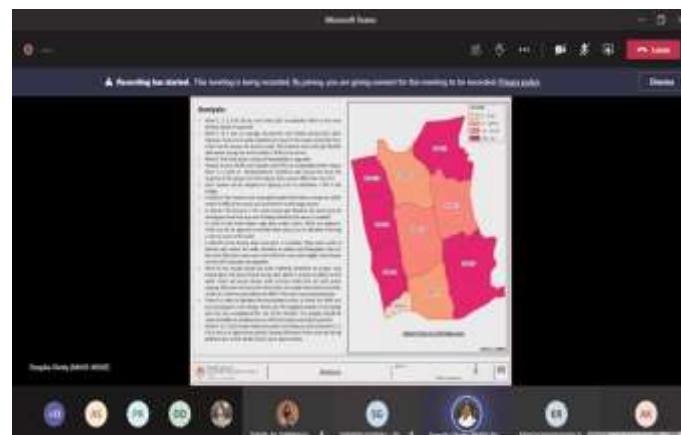


Figure 3.12 Data Analysis through virtual Meeting- Team MSAP.

Source: GP Survey Group, MSAP

WEEK- 20 and 21:

Meeting with Stakeholders with Proposed Development Proposals for both GPs.

The stakeholders meeting was conducted in MSAP on 20 October 2020, where the development proposals were projected for their feedback and recommendations.

The stakeholders' inputs were more focused towards alternate job opportunities, solid and liquid management solutions, education and healthcare services.

WEEK- 23:

Finalization of Spatial Development Proposal and Submission of Report for both GPs.



Stakeholder meeting : Uppunda

The inputs from both GP stakeholders were incorporated in the Master Plan of the Proposal for both GPs based on the vision document of Udupi 2025. The paradigm of place because of the historical evolution of the GPs were considered in the final proposal. The development of socio- economic and physical infrastructures in line with Vision 2025 were incorporated in the Master Plan proposal.

WEEK- 24-27:

Presentation of final plan and report to state coordinators and Ministry of Panchayati Raj, Govt of India.

The inputs from both GP stakeholders were incorporated in the Master Plan of the Proposal for both GPs based on the vision document of Udupi 2025. The paradigm of place because of the historical evolution of the GPs were considered in the final proposal. Chapter of updated maps and analysis was received from NRSC on Nov 17th 2020. The development of socio- economic and physical infrastructures in line with Vision 2025 were incorporated in the Master Plan proposal. The final plan was presented to state coordinators on 19th Nov 2020 and to Ministry of Panchayati Raj and national level teams on 2nd Dec 2020.



4. Natural Setting- Kestra

4.1 Introduction

The coastal area is fragile in nature which needs special attention while visualizing any planning activities. In the three-tier (District, Block, and Village) Panchayat raj system, the village plays a vital role as most of the planning activities can be successfully implemented when done at the grass-root level. Nowadays, remote sensing technology along with geographical information systems (GIS) can act as a useful tool in any decision-making process. The terrain information and its attributional data can be well analyzed through high-resolution satellite images and geospatial technologies. In planning activities, the role of geospatial technology is increasing day today. Information on a different theme of the study area can be analyzed and different spatial planning at the village level can be initialized.

4.1.1 District profile

Udupi district (13° 20' 27" N, 74° 44' 31" E) of Karnataka is situated on the western coast of peninsular India. This is separated from the rest of the peninsula by the Western Ghats. It has vast areas under the coastal belt and undulating plateau. The geographical area of the district is 3,575 km². There are three Taluks, 146 numbers of the panchayat, and 267 villages in the Udupi District. The district has a population of 1,177,361 and 146 numbers of a panchayat (Census, 2011). These coastal landforms are low and sandy and have broken and rugged rocks. These undulating plateau support scrubby, deciduous, and semi-evergreen vegetation that invariably extends up to the foot of Western Ghats. These evergreen forests occur on upper slopes of ghat regions, annually receive rainfall of above 4000 mm. The forest resources significantly contribute to the State's Gross Domestic Product (GSDP) by being a major source of timber, medicinal plants, non-timber forest products (NTFPs), grazing, recreational activities, carbon sequestration, watershed provisions, etc. The important crops are coconut, paddy, areca nut, pepper, cashew, and rubber, etc. (Forest Department of Karnataka report, 2011)

The total geographical area of the Udupi district is 3575 sq.km, which constitute about 1.86 percent of the total geographical area of the state. The district has three distinct natural regions; coastal region with a coastal belt of about 98 kms, rolling midland plain terrain, covering 75 percent of the district and mal-nad region and the Ghat section with hills and thick forests. Many rivers take birth in the foothills of Western Ghats, flowing westwards and joining the Arabian Sea.

The district has a 90km long coastal belt which provides good scope for fisheries in Udupi and Kundapura taluks. The coastal belt has a large number of wetlands, backwaters, estuaries and creeks, mangroves, salt marshes, and lagoons. Malpe, Kaup, Thrasi and Maravanthe beaches are well known and have good tourism potential. The wildlife of the Udupi district is both abundant and varied with a variety of fauna which is both small and big, including vertebrates. The fauna and more particularly the percentage of larger mammals essentially

reflect the abundance of flora in the area. This area has no. of species like dwelling animals: monkeys, giant mammals: bison, elephants, and deers (Prajapati, 2010). The Someshwara Wildlife Sanctuary in Udupi is situated towards the southwest of the larger section. The sanctuary is mostly made up of evergreen forests, semi-evergreen and moist deciduous forests. It is situated very close to the much bigger Kudremukh National Park. There are several animals live



Figure 4-1 Uppunda location map.

Source: Open Street Map ,QGIS software, Layers added by Author

in the environs of the sanctuary like Barking Deer, Bonnet Macaque, Common Langur, Gaur, Jackal, Leopard, Lion Tailed Macaque, Sambar, Spotted Deer, Tiger, Wild Dog, and Wild Pig. There are also a few exquisite birds found like Ceylon Frogmouth, Malabar Pied Hornbill, Malabar Trogon, and Malabar Whistling Thrush. The reptiles and butterflies are also found in this sanctuary. Reptiles like Pythons, Monitor Lizards, and King Cobras abound in the forest. The flora and fauna of Coastal Karnataka, comprising of Dakshina Kannada, Udupi, and Uttara Kannada are depicted in Table 4.1 (D'Cunha and Nair, 2013; Gowda, 2013; Rao and Suvama, 2016; Narasimhaiah et al., 2016).

4.1.2 Agriculture

Agriculture is the backbone of the Udupi district's rural economy, where the majority of the population lives. In these coastal areas, fishing is the main occupation whereas, agriculture (sugarcane) and allied activities contribute 17 % to the district's gross domestic product (GDP). During the 2014-15 crop years, the net cultivated area was 96974 ha and the gross cropped area was 110929 ha and the cropping intensity works out to be 1.14. The district witnessed a steady deceleration in the gross cropped area since 2001. The gross cropped area declined from 133261 ha in 2000-01 to 110929 ha in 2014-15. The cropping intensity which was 1.31 has reduced to 1.14 during this period. The irrigated area is mainly through wells, tanks, and check dams in the Udupi district. At present, the district has not any operational major or medium irrigation projects.

The district has one of the lowest percentages of the area under cultivation in the state. The net cultivated area in the district is 27 percent of geographical area as compared to the state's 55 %. It has been reported that the proportion of the net cultivated area is the highest in Udupi taluk (34 %), followed by Kundapura (27 %) and Karkala has the lowest (22 %). The gross cropped area in the district is 1.11 lakh ha. The cropping pattern in Udupi is mainly concentrated on paddy. During the crop year 2014-15, the total area under paddy was 49555 ha. Paddy crop was mainly raised during Kharif - the rainy season. In Rabi season, pulses and oilseeds like black gram, horse gram, green gram, and cowpeas have grown and the statistics shown that the area under pulses was 3948 ha in 2015. Moreover, the Groundnut has been the main oilseed grown in the district and it grows in 1800 ha, Sesamum grows in 36 ha, and other oilseeds in 29 ha. Paddy accounts for nearly 47 percent of the total gross cropped area, followed by pulses (4.6 %) and oilseeds (1.8 %). Sugarcane, which was grown once in about 2000 ha, is now abandoned with the break-down of the Brahmapur sugar factory.

The district has substantial acreage under horticultural crops. Coconut accounts for 17798 ha, areca nut 7837 ha, cashew-nut 19373 ha, rubber 4693 ha, banana 992 ha, black pepper 353 ha, and vegetables 1533 ha. In Kharif season, under rain-fed condition, cereal crops are sown in an area of 43012 ha, and in rabi and summer, it is sown in an area of 6537 ha. During rabi and summer seasons, pulses and oilseeds are sown in an area of 3648 ha and 1799 ha respectively. The district is also known for growing Mallige in 214 ha. The cropping patterns in the district of Udupi, Karnataka are given in Table 4-1 (www.pmkys.gov.in).

Table 4-1 Cropping pattern in Udupi district, Karnataka

Sl No.	Crops grown	Area under crop (ha)	Percentage share
1	Food crops: paddy	49555	44.68
2	Maize	30	0.01
3	Pulses	3948	3.56
4	Oilseeds	1865	1.68
5	Plantation crops	25767	23.23
6	Fruit crops	22433	20.22
7	Vegetables	1533	1.38
8	Sugarcane	53	0.01
9	Flowers, spices and other crops	5798	5.23
10	Total	110929	100.00

4.1.3 The ground water quality:

The Granitic gneisses with occasional laterite capping and unconsolidated river and marine sediments occupy in area of Udupi district. The gneiss is wide spread in the distinct outcrops at varying magnitude especially along river courses. Basic intrusives like dolerites and gabbros and acidic intrusive like pegmatite and quartz



veins and pink porphyritic granites are found all over area of the district. The ground water in the Udupi district region mainly occur in various geologic formations like beach alluvium, coastal sediments, laterites and in weathered and fractured granitic gneisses under phreatic and semi-confined to confined conditions, but mainly under water table conditions. Coastal alluvium along with the laterites occur as an aquifer of phreatic nature. The hydrology of the Udupi district can be subdivided into two broad hydrogeological units like a) hard and fissured formations in the pediplain and porous unconsolidated formations on the coast (www.cgwb.gov.in). Based on the occurrence and behavior of groundwater, the ground water system of the district is described under four zones in general such as shallow zones up to 25m, moderately deep zone (25-60 m), deep zone (60-100m), and very deep zone (beyond 100m) respectively. The quality of groundwater has been reported by Central Ground Water Board in 2008 that, at certain depths in the sandy aquifer are found good and potable and in the adjoining areas covered by lateritic/weathered gneissic rocks. The dug wells in the alluvial area generally yield saline water during summer months and get fresh water during monsoon periods.

4.2 Study area

4.2.1 Udupi district

This district is located at 13° 20' 27" N, 74° 44' 31" E of Karnataka is situated on the western coast of peninsular India. This is separated from the rest of the peninsula by the Western Ghats. The district has vast areas under the coastal belt and undulating plateau. The geographical area of the district is 3,575 km². There are three Taluks, 146 numbers of panchayat, and 267 villages in Udupi District.

4.2.3 Uppunda Gram Panchayat

Uppunda (13°50'05.6"N, 74°37'33.7"E) is a village in Byndoor taluk in Kundapura block of Udupi district in the state of Karnataka is in the western coast of peninsular India. In the north, the gram panchayat is abutted by the Baindur River. In south, Yadamavu River and the west has a 2.46 km long beach coast along the Arabian sea. It experiences a humid climate with 76% humidity, Max. avg temperature of 32 degrees Celsius. The site profile is such that, the coastal road and the NH are at

higher elevation (13 meters above sea level) and the midland is at a lower elevation- thereby giving the site an almost bowl like sectional profile. Main occupation here is fishing and agriculture.

The National Highway (NH) 66 – Goa-Mangalore highway passes through this gram panchayat (GP). The GP is situated 31 km away from sub-district headquarter Kundapura and 67 km away from district headquarter Udupi. Uppunda gram panchayat has total geographical area of 584 hectares respectively. Byndoor is the nearest town to Uppunda which is approximately 5 km away. The study area can be accessed through Udupi headquarter and it is well connected with a transportation network. The study area is depicted in Figure 4.2.

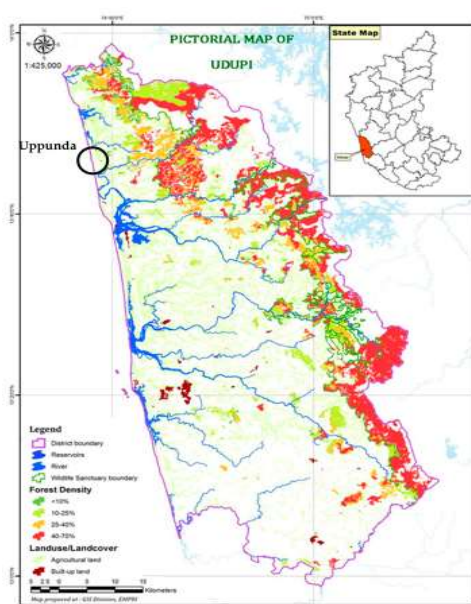


Figure 4-3 Udupi District Map,
Source: ENVIS center, MoEF, GOI



Figure 4-2 Study area location map.
Source: Google Earth

4.3 Climate:

As Uppunda comes under Byndoor taluk, here is the details related to the climate of Byndoor Taluk

Temperature - The hot season lasts for 2 months, from March to May, with an average daily high temperature above 32°C. The cool season lasts for 3 months, from June to September, with an average daily high temperature below 30°C.

Clouds - The cloudier part of the year begins around April and lasts for 6 months, ending in the month of October.

Precipitation - The wetter season lasts for 5 months, from May to October, with a greater than 47% chance of a given day being a wet day. The chance of a wet day peaks at 94% during July.

Rainfall - The rainy period of the year lasts for 8 months, from March to December. The most rain falls during the 31 days centered around July, with an average total accumulation of 33.7 inches.

Humidity - Byndoor experiences significant seasonal variation in the perceived humidity. The muggier period of the year lasts from January to December, during which time the comfort level is muggy, oppressive, or miserable at least 72% of the time.

Wind - The windier part of the year lasts for 4 months, from May to September, with average wind speeds of more than 8.9 miles per hour. The windiest month of the year has an average hourly wind speed of 12.3 miles per hour.

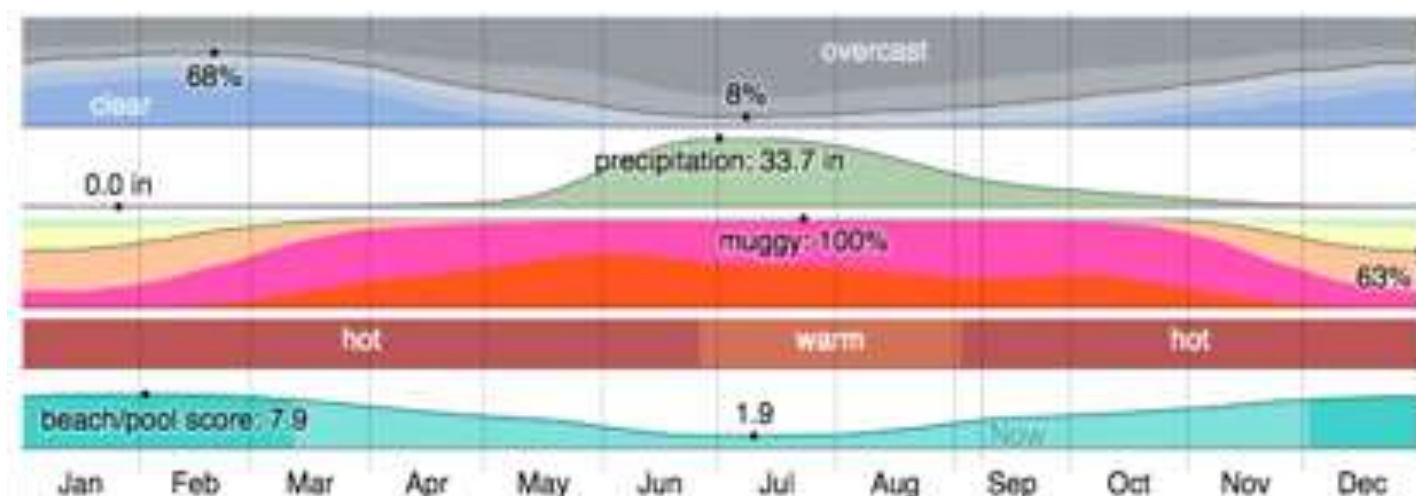


Figure 4-4 Climate summary

Source - weatherspark.com

4.3.1 Wind & Waves

Wind patterns during October to February, changes direction from north and northeast and moves towards southwest to south to the south of 160 N. This trend continues till March. Wind speed range from 4-15 m/sec. The majority of the winds has speeds greater than 8 m/sec, which is responsible for storm waves that prevails during the southwest monsoon from June to August. During the post-monsoon from September to December, winds approached the coast from WSW and W and their speed decreased to 10 m/sec with a prevailing seaward breeze. The significant wave height near shore is greater than 1.5 m (Range: 0.2-1.4) during the fair weather season, and greater than 3 m (Range: 0.6-3.4 m) during the storms during the southwest monsoon. The average fair weather wave height is 0.6 m, while the height during the monsoon and post-monsoon seasons were 1.5 m and 0.7 m, respectively. (<https://weatherspark.com/y/107838/Average-Weather-in-Byndoor-India-Year-Round>).

4.4 Soil

The district is covered with three types of soil: i) sandy soil covering the beaches and the adjoining stretches ii) yellow loamy soil and iii) red lateritic soil. Distribution of soil in percentage is shown in Figure 6. The sandy soils are confined to a narrow strip of the coast having width ranging from less than 100 m to as much as a kilometer.

(<http://hdl.handle.net/10603/152831>)

Uppunda mainly consist of Sandy soil and fine loamy soil. Sandy soils are highly pores and have low fertility. It has Low load bearing capacity. Sediments are present till 9 Meters.

Issues - Spit growth, narrowing of the river mouths, shifting of the river moths, and erosion of the opposite banks are common problems.

Erosion of the spit-end and movement of the materials into the estuary and causing siltation in the estuary.

In Figure 8, it can be seen maximum built up is in sandy soil which is why majority of built ups are G-G+1 structures as sandy soil has low load bearing capacity. Also due to unconsolidated sediments, it is not suitable for heavy construction.



Figure 4-6 Soil Map of Udupi District,
Source: Pradhan Mantri Krishi
Sinchayee Yojana

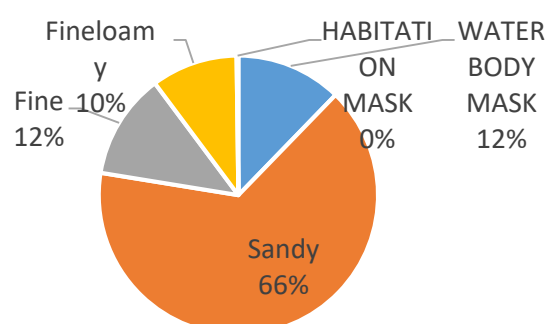


Figure 4-7 Uppunda Soil Pattern Percentage,

Source: NRSC Prepared by MSAP GPSDP Team

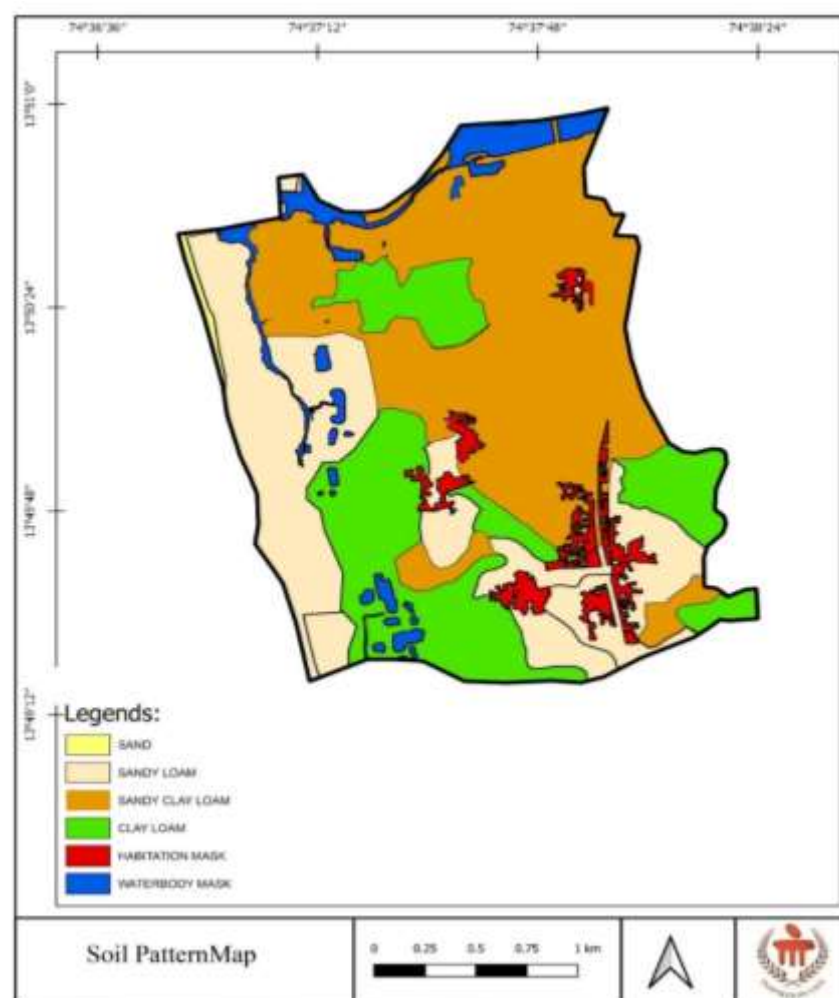


Figure 4-5 Uppunda Soil Pattern, Source: NRSC Prepared by MSAP GPSDP
Team

4.5 Geology

Uppunda lies under alluvium class. The site has migmatitic gneissic complex, locally capped by laterites and Quaternary alluvium. Alluvial soils are soils deposited by surface water. Mainly found along rivers, in floodplains and deltas, stream terraces. Alluvial soils provide many functions: Alluvial soils remove sediments and nutrients flowing in the adjacent water, They can also remove other contaminants from rivers and improve water quality for downstream communities. (Ricker, 2020)



Figure 4-9 Udupi Geology Map

Source: Dist. NRDMS Center, Udupi

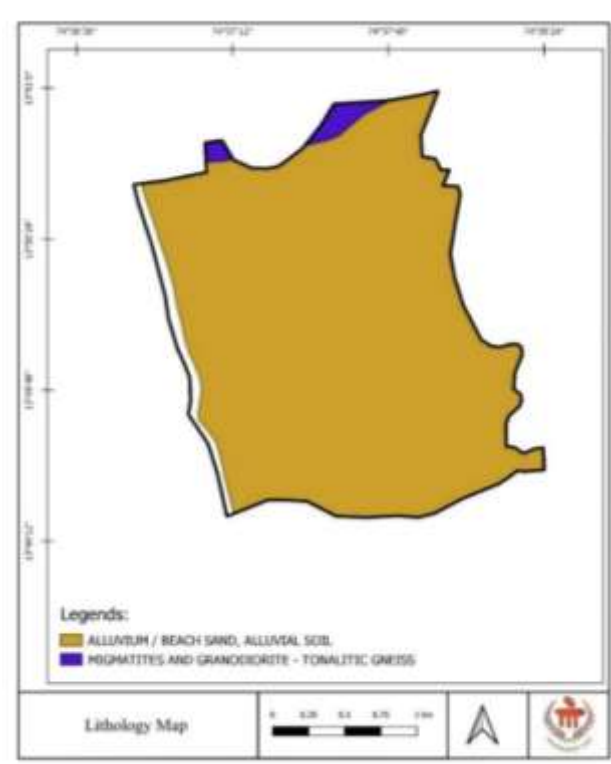


Figure 4-8 Uppunda Lithology Map

Source: NRSC Prepared by MSAP GPSDP Team

Uppunda is Majorly Young plains. Since Uppunda lies in a coastal plain with soft underlying sediments, the rivers flowing in these areas take a curved course & keeps changing its course. It is recommended no construction along the course. On over-lapping the two major conflicts points can be found mainly because of settlement encroachment which may obstruct the natural water flow may create drainage issue in the future.

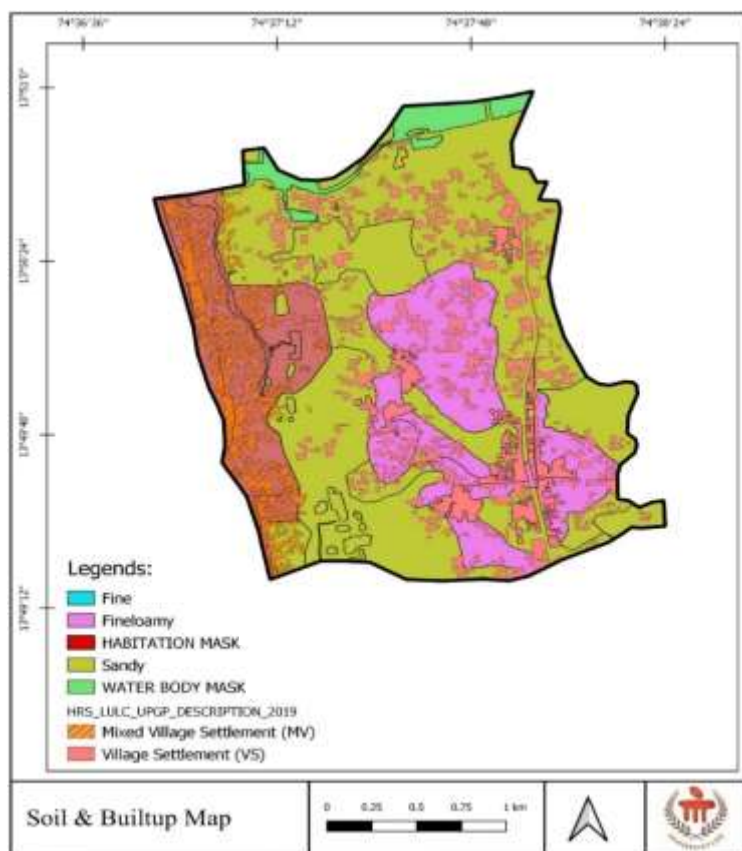


Figure 4-10 Uppunda Soil + Built up Map,

Source: NRSC Prepared by MSAP GPSDP Team

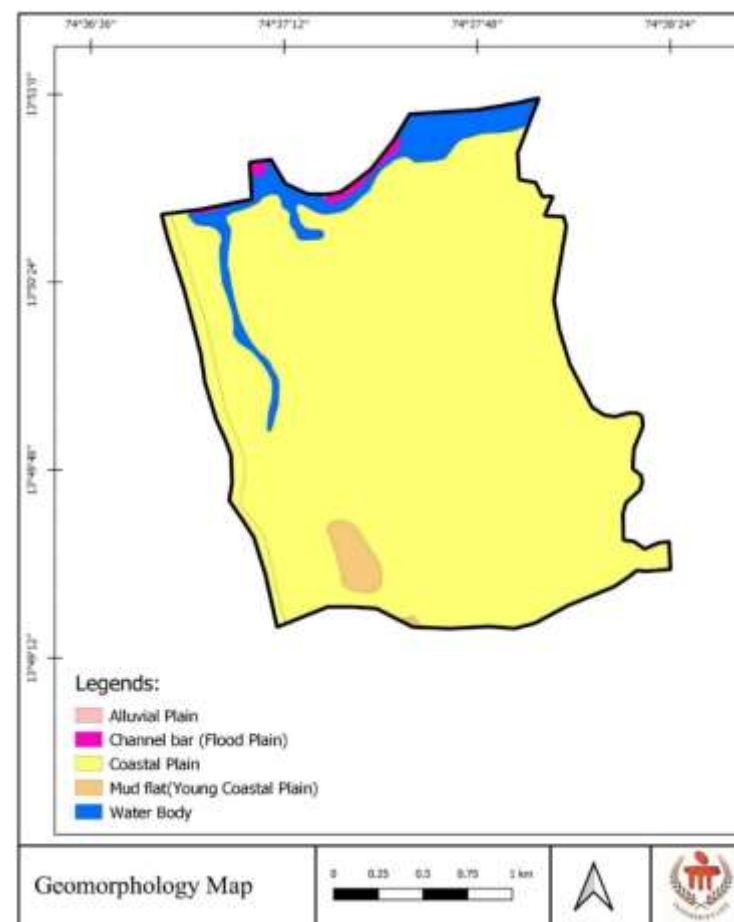


Figure 4-11 Uppunda Geomorphology Map

Source: NRSC Prepared by MSAP GPSDP Team

4.6 Land use and land cover

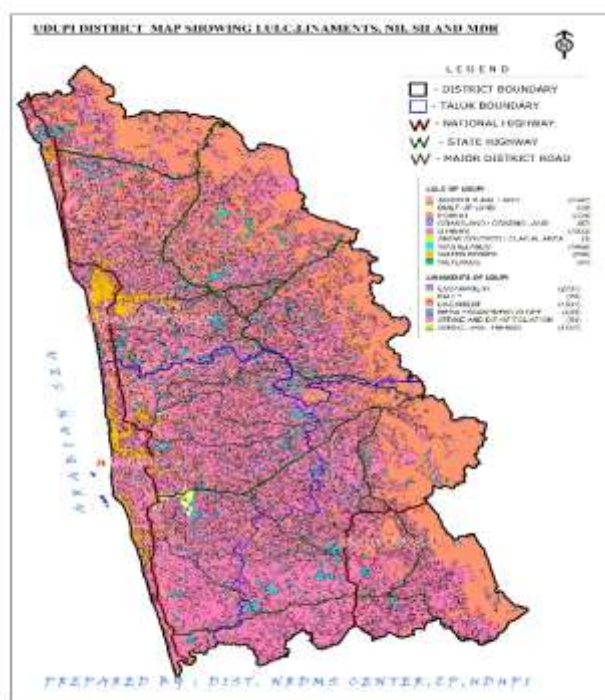


Figure 4-12 LULC of Udupi District

Source NRDMs

LULC is classified into Plantation / Orchards (AP), Aquaculture (AC), Crop Land (CL), Hamlet & Dispersed, Household (HD), Lakes / Pond (LP), Mixed Village Settlement (MV), Open areas along the coast, Open land next to highway, River (RI), Sandy area - Coastal (SC), Sea wall along the coast Sparse scrub land (SS), Transport Network (TN), Village Settlement (VS), Waterlogged (WL). Agriculture is dominant in this area which comprises agricultural land, which now

The

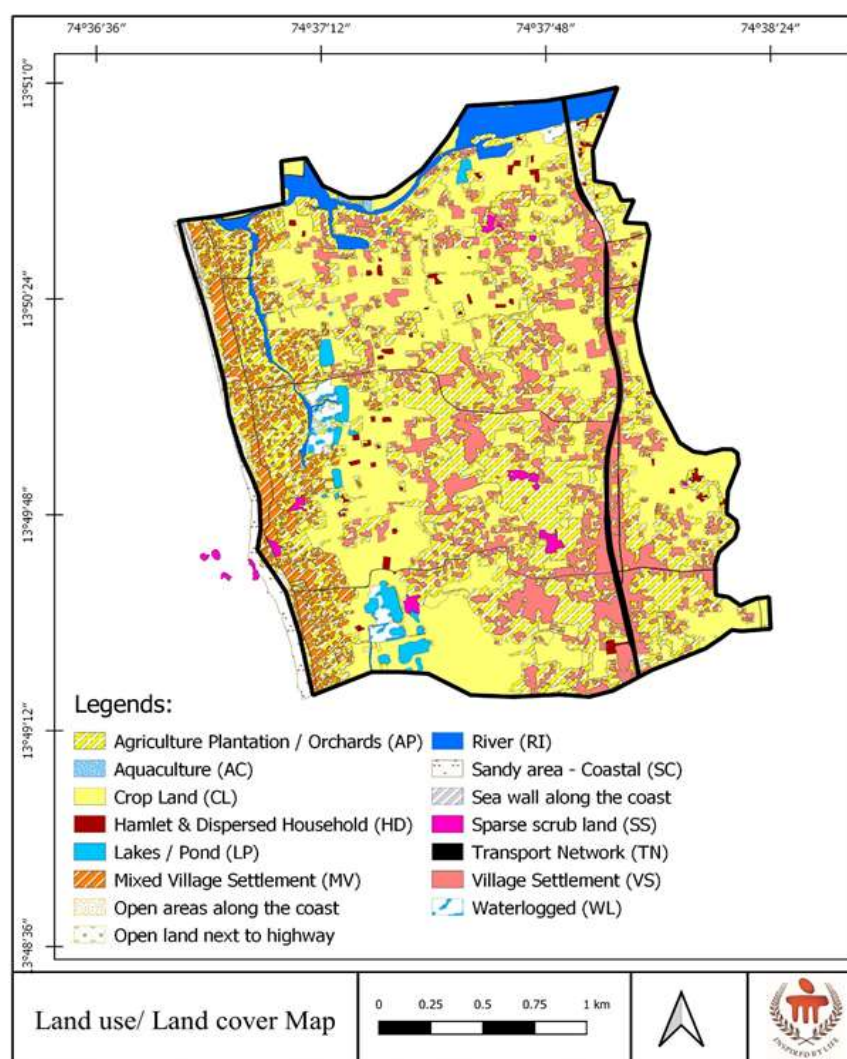


Figure 4-13 Uppunda Land use /Landcover

Source: NRSC Prepared by MSAP



sprouts dairy farming in lieu of its crop-cultivation failure (Naik, 2019). The district land use and land cover is depicted in Figure 4.11.

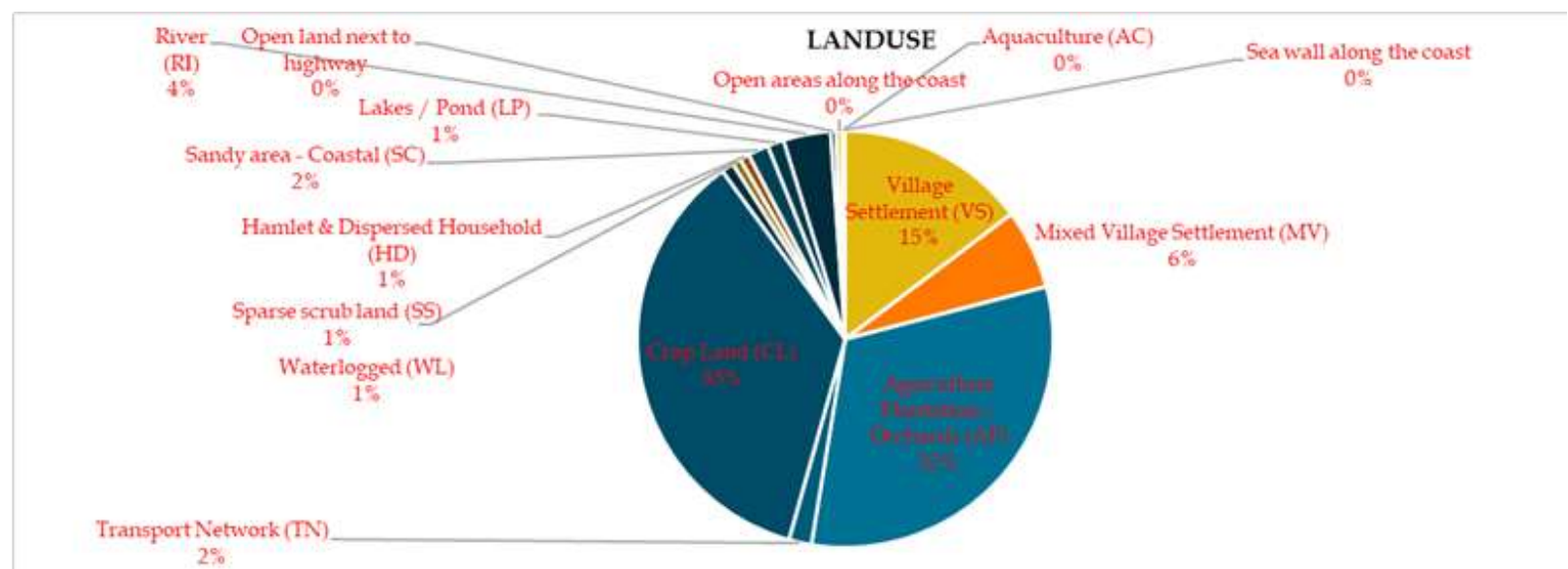


Figure 4-14 Uppunda LULC Percentage

Source: NRSC Prepared by MSAP

4.7 Topography

Uppunda has a flat topography underlined with marine sediments. These sediments were deposited because of marine transgression and regression. Ground elevation in the GP varies from 2 to 18m above mean sea level. The beaches here are shorter than the other parts of the district. From the slope analysis it was observed that the site has a gentle slope towards south west direction. According to contour map, major portion of Uppunda, comes at 7m which according to the slope map has gentle sloping.

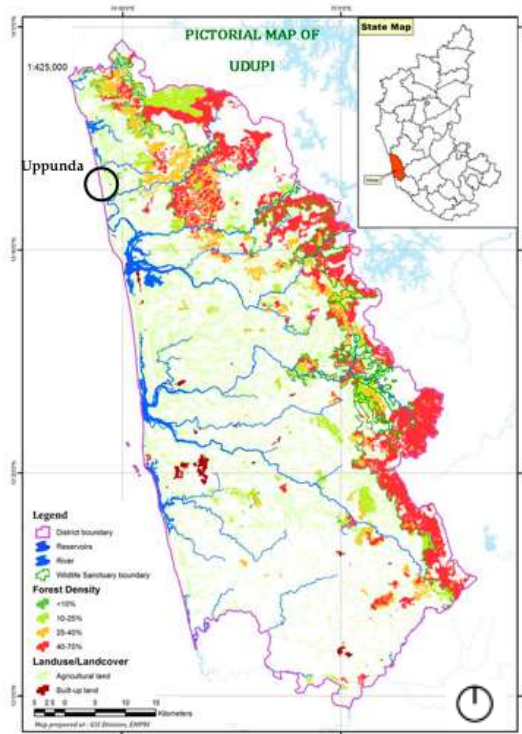


Figure 4-15 Physiography Map of Udupi District showing location of Uppunda village

Source: ENVIS center, Ministry of environment and forest, govt. of india

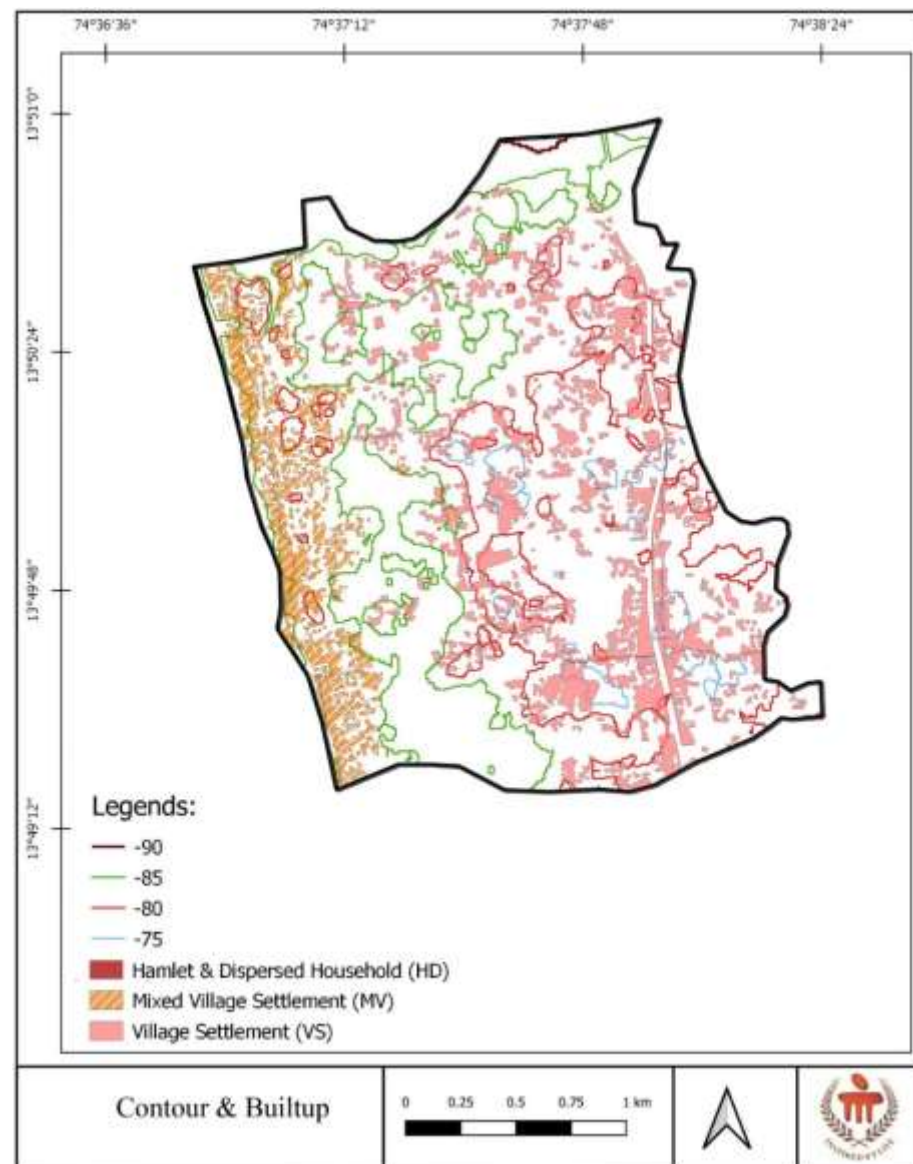


Figure 4-16 Uppunda Contour & Builtup Map

Source: NRSC Prepared by MSAP GPSDP Team

Above figures shows, the slope profile of the GP where central portion is clearly at lower level (equivalent to the sea level) as compared to other sides which is at a slightly higher elevation. Thus, giving a bowl like section profile. This is the main reason for stagnation of water in the central area as observed on site.

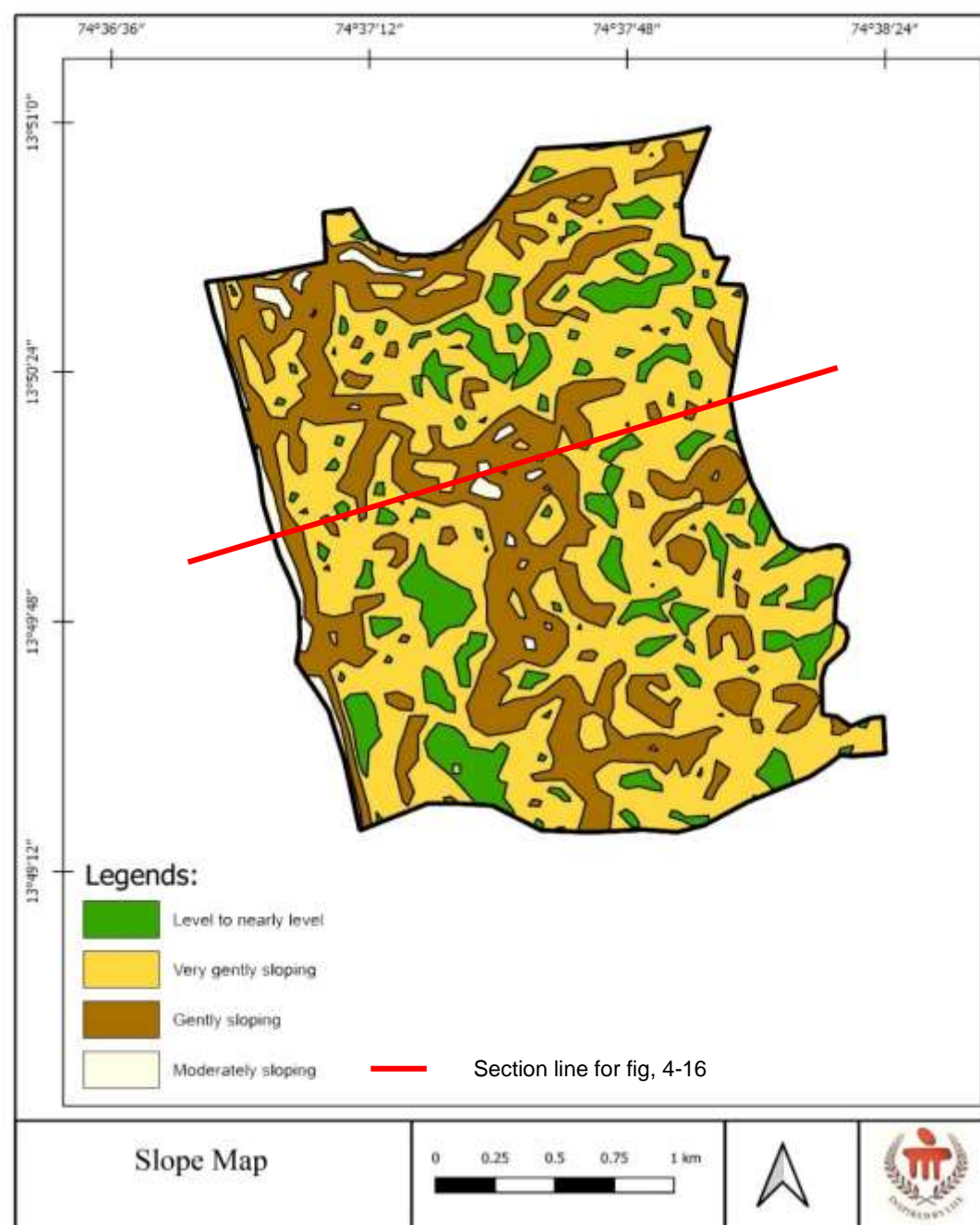


Figure 4-18 Slope analysis;

Source: NRSC Prepared by MSAP GPSDP Team

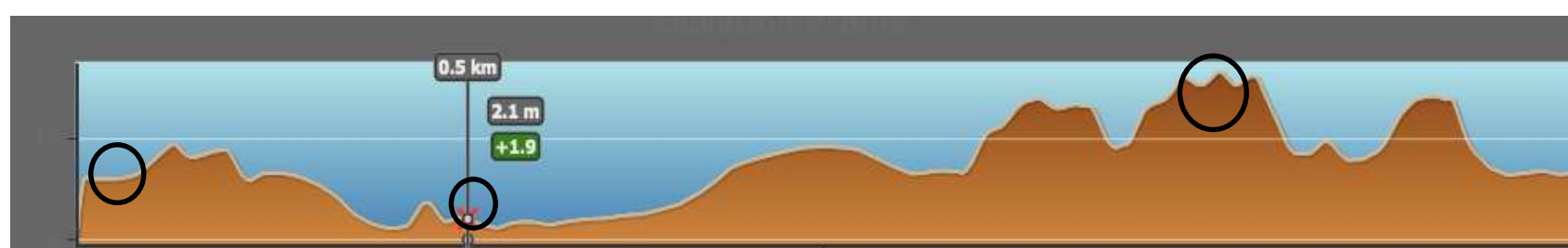


Figure 4-17 Schematic Section at section line (red dash line) shown in Fig. 4-15 ;

Source: Google Earth

4.8 Hydrology

With the heavy rainfall, the district is blessed with many rivers and tributaries. The district has river basins of Shambhavi (Mulki), Swarna, Yennehole, Madisala, Sita, Haladi, Chakravani, Swaparnika (Kollur), Gangolli and Sankadagudi hole sub basins. The State of Karnataka is drained by the rivers Krishna, Cauvery, Godavari, West flowing minor rivers, Palar, Pennar and Ponnaiyar. Uppunda is bounded by two rivers (Baindur and Yadamavu River) on the north and south parts of the GP, both joining the Arabian sea. Since Uppunda lies in a coastal plain with soft underlying sediments, the rivers flowing in these areas take a curved course. This was observed in the southern coasts of Karnataka as well where the rivers flow to the sea keeps changing its course because of the soft sediments. The subsurface aquifer here is phreatic, which means the groundwater present here is in unconfined condition. Almost all the groundwater wells present in the GP is limited to the phreatic aquifer. The groundwater along the coastal part of the GP is saline and



alkaline in nature. Therefore, it is not preferred for drinking. The salinity and alkalinity vary with season (low in post-monsoon and high in pre-monsoon). Apart from being saline, the wells in this GP has a good yield.



Figure 4-20 Drainage map of Udupi District

Source: District NRDMS Centre, ZP, UDUPI

4.8.1 Water quality:

The physico-chemical analysis of well, river and municipality water samples of Uppunda Gram panchayat, Udupi area were estimated using various methods.

The physico-chemical parameters

Table 4-2 Physico-chemical quality parameters results of groundwater samples in well, municipality supply and river Uppunda Gram panchayat, Udupi, Karnataka.

Source: MSAP GPSDP Team

Uppunda							
Water samples	pH	Electrical Conductivity ($\mu\text{S cm}^{-1}$)	Oxidation-Redox potential (Eh), mV	TDS (mg/L)	Temp ($^{\circ}\text{C}$)	Acceptable limits 10500:2012	Permissible limits (IS:10500-2012)
well	6.57	349	246.3	174	26.13	pH-6.5-8.5	pH-No relaxation
River	6.57	255	246.5	127	26.07	TDS-500	TDS-2000
well	6.59	378	261.2	189	24.69	EC-NA	EC-NA
well	6.86	247	254.8	124	26.26	ORP-NA	ORP-NA
well	6.84	265	237	132	25.48	Temp-NA	Temp-NA
well	6.38	460	275.3	230	25.35		
well	6.77	239	242.1	119	26.69		
well	7.24	219	248.9	110	27.75		
well	6.85	116	228.5	58	26.89		
well	6.7	495	253.6	394	25.89		
well	7.29	581	240.7	791	24.84		
well	7.32	417	219.6	208	25.87		
well	7.09	495	239	248	24.97		
well	7.48	425	224.9	208	25.87		
Municipality	6.85	169	266.4	84	26.37		
well	6.24	244	247.4	122	25.22		

measured include pH, electrical conductivity (EC), total dissolved solids (TDS), oxidation redox potential (Eh),

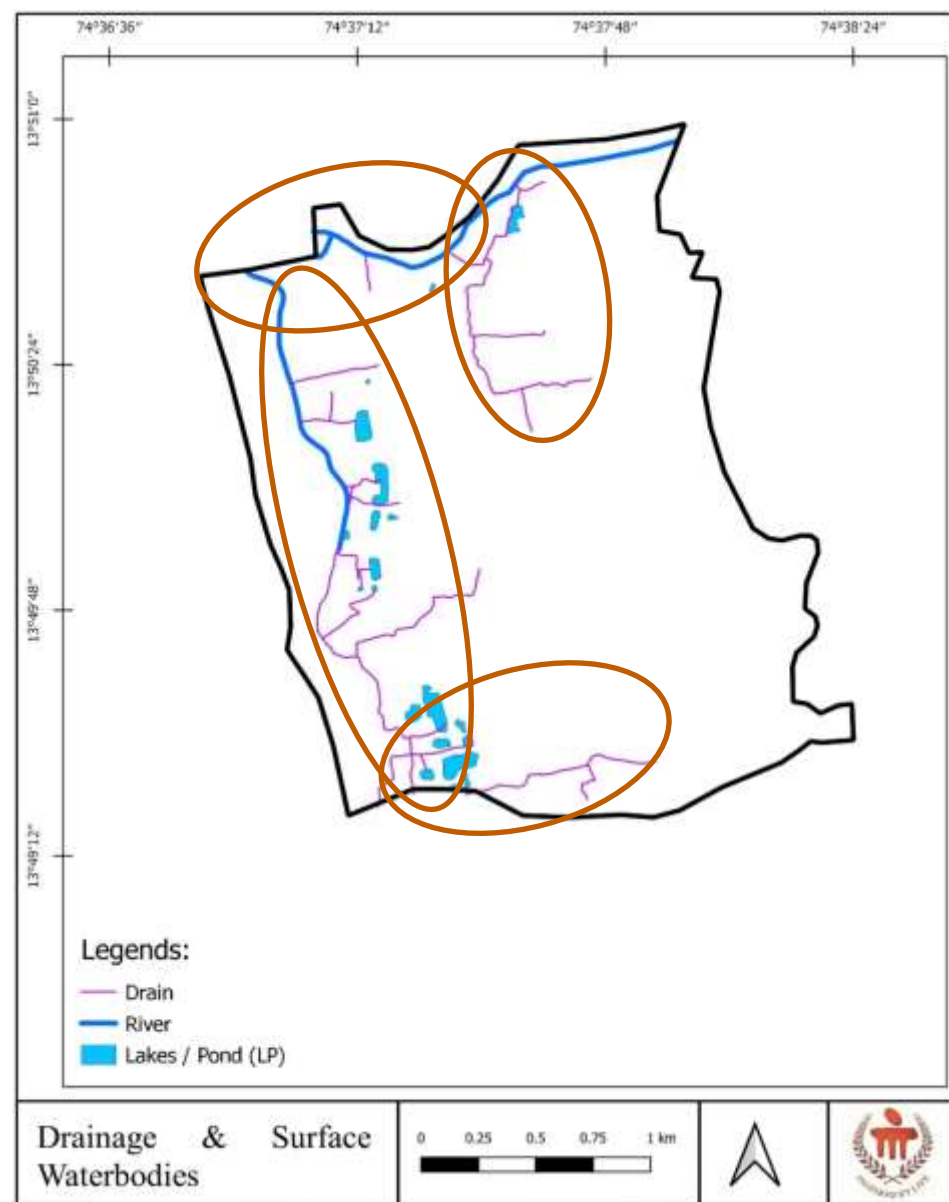


Figure 4-19 Uppunda Drainage & Surface Waterbodies

total alkalinity (TA), dissolved oxygen and temperature. The physico-chemical quality parameters of Uppunda and Shankaranarayana Gram panchayat are given in Table format.

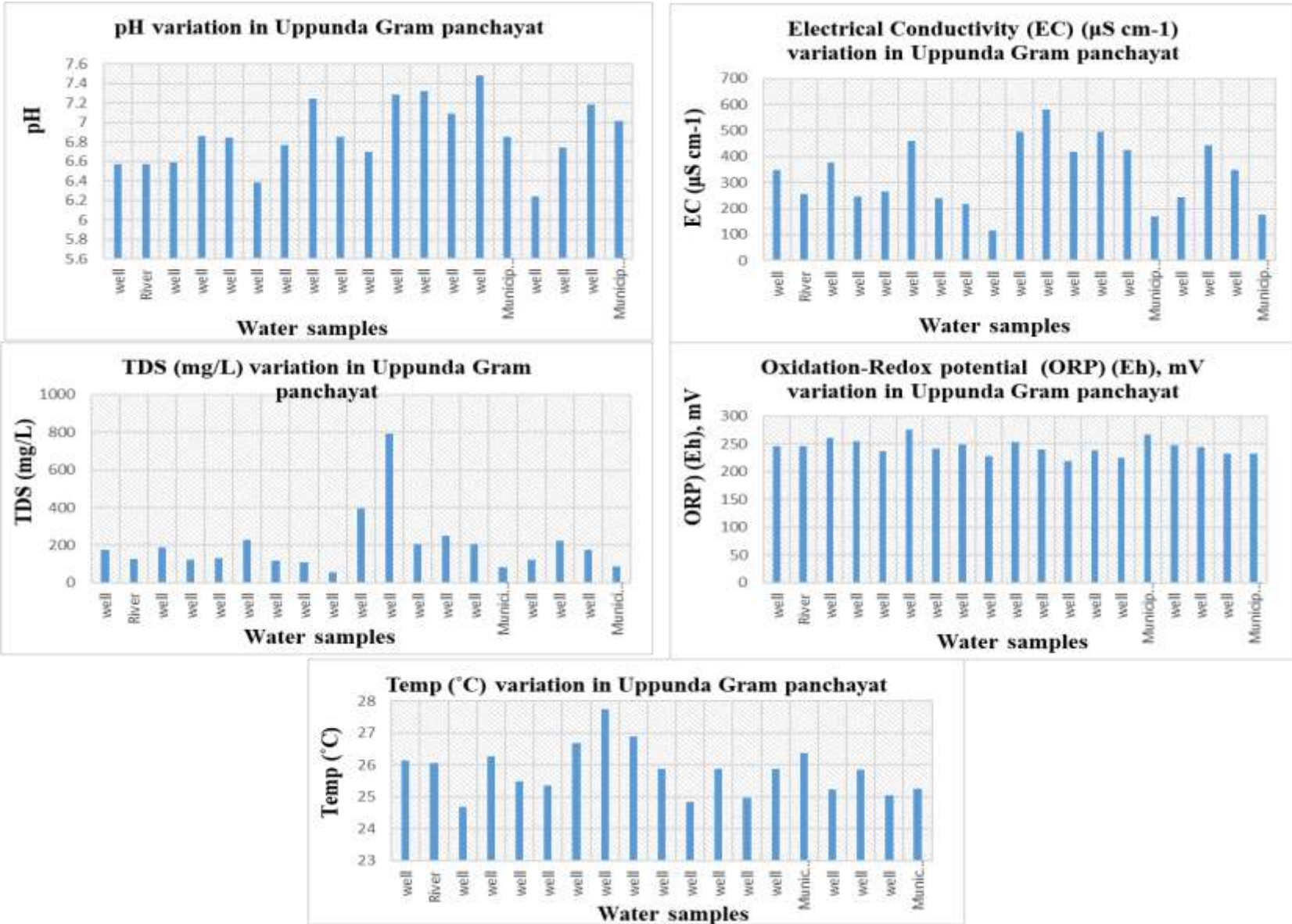


Figure 4-21 Analysis of collected water samples;

Source: MSAP GPSDP Team

Analysis:

The results of the analysis in Uppunda Gram panchayat indicated that the quality of groundwater does not vary to a great extent. The well, river and municipality supply water samples are well below permissible limit, however the well and municipality supply water are slightly alkaline and highly conductive due to the marine shell deposits in Uppunda Gram panchayat area.

4.8.2 Ground Water Table

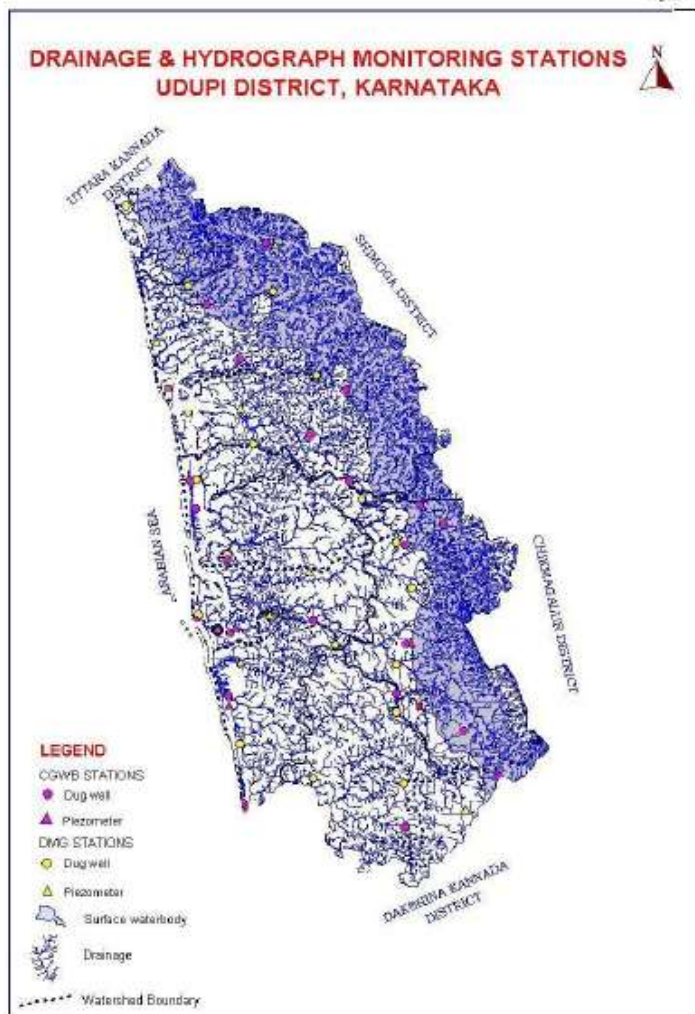


Figure 4-24 Drainage and Hydrograph Monitoring Stations, Udupi District, Source: Central Ground Water Board-2008

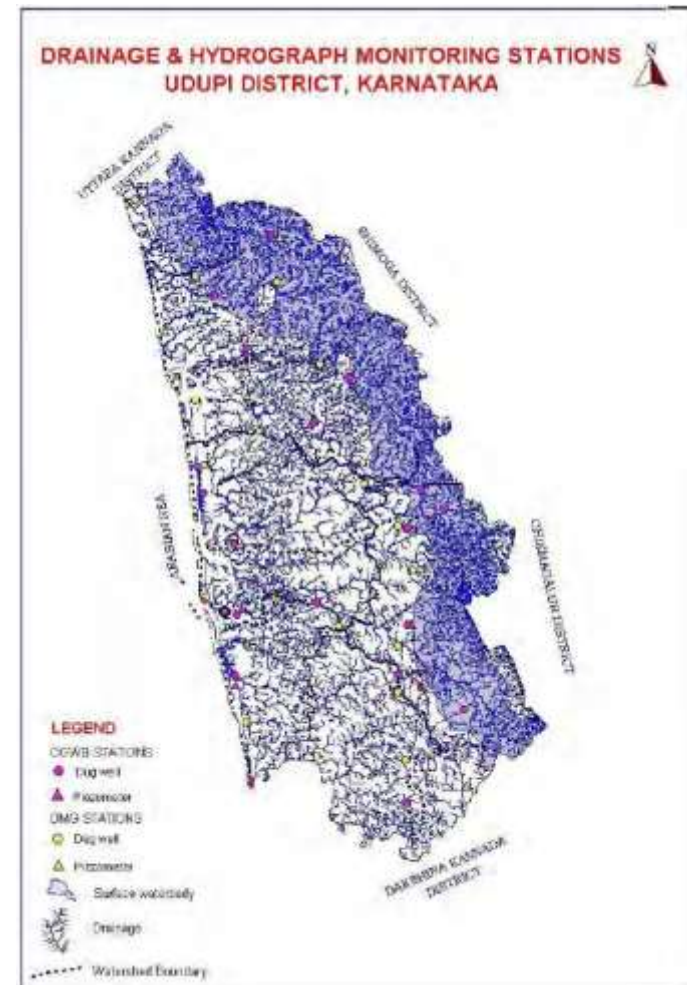


Figure 4-22 Figure 4-23 Drainage and Hydrograph Monitoring Stations, Udupi District, Source: Central Ground Water Board-2012

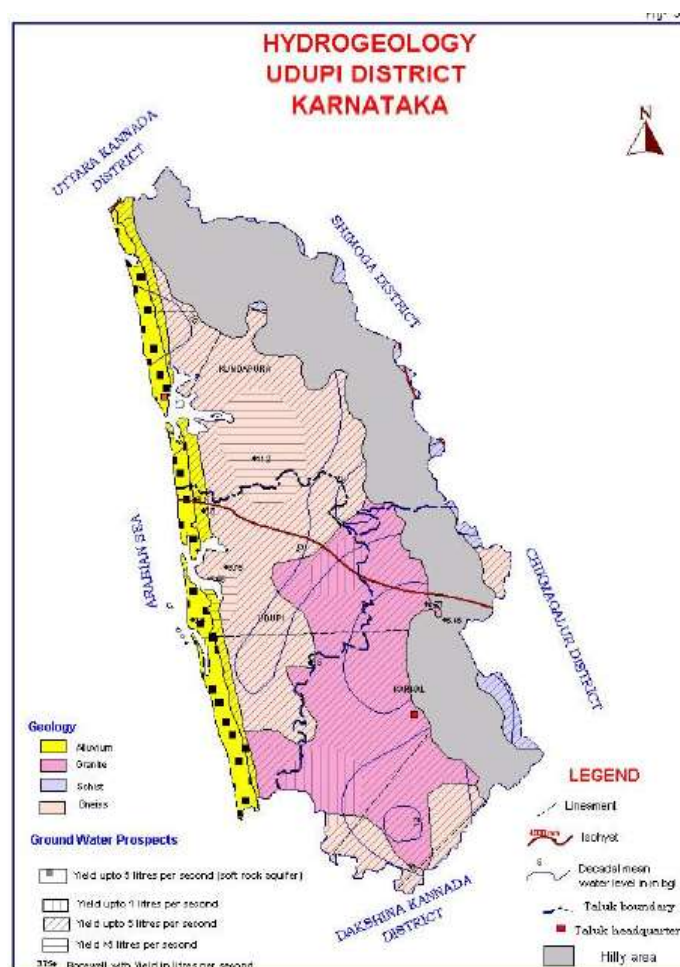


Figure 4-26 Hydrogeology, Udupi District, Source: Central Ground Water Board-2008

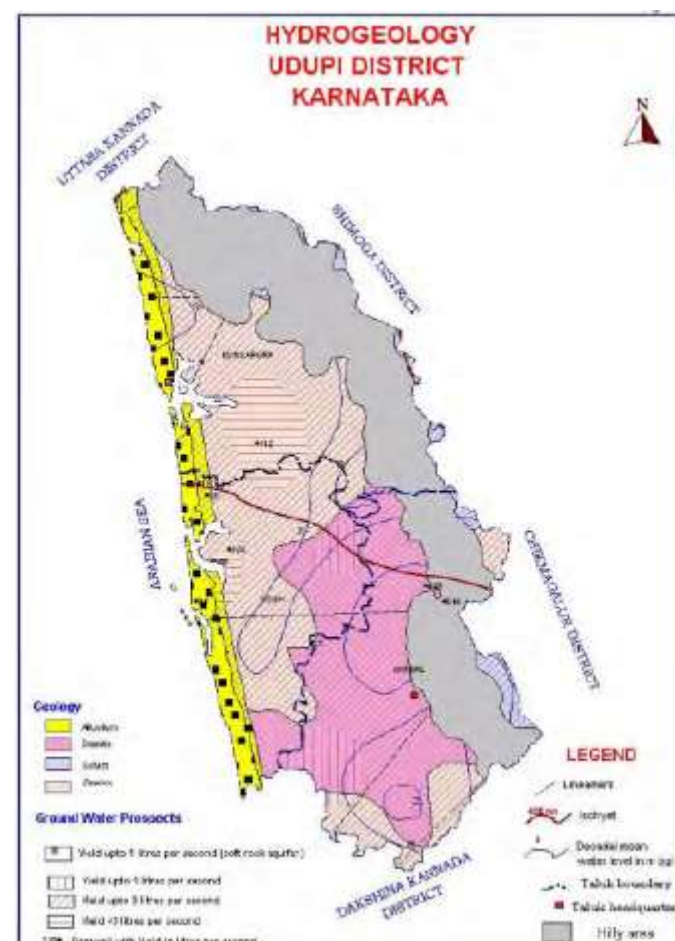


Figure 4-25 Hydrogeology, Udupi District, Source: Central Ground Water Board-2012

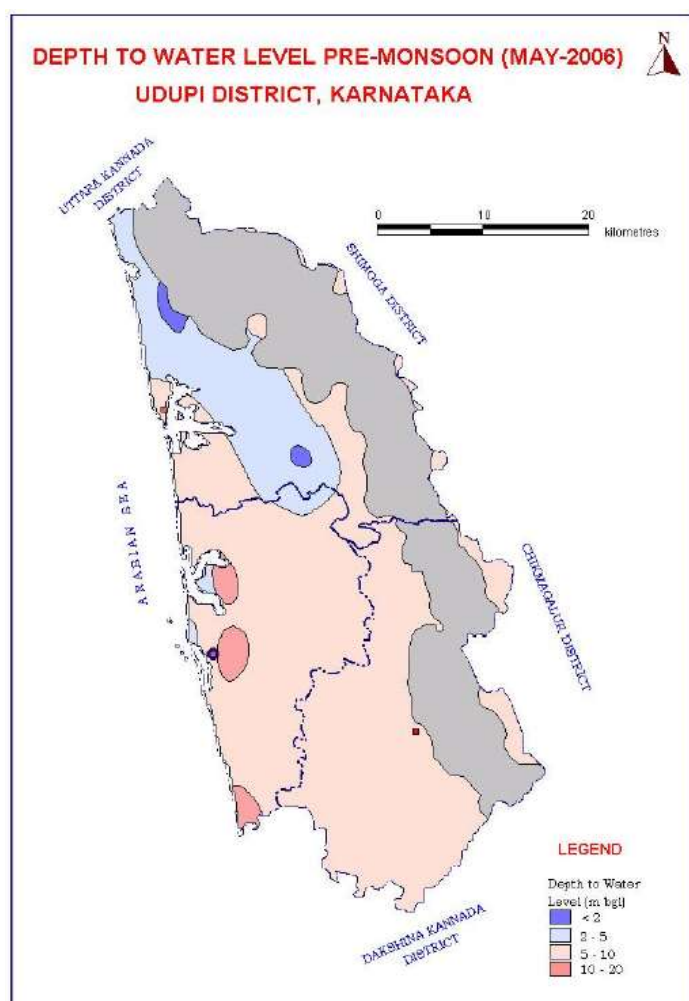


Figure 4-27 Depth to Water level Pre monsoon, Udupi District,

Source: Central Ground Water Board-2008

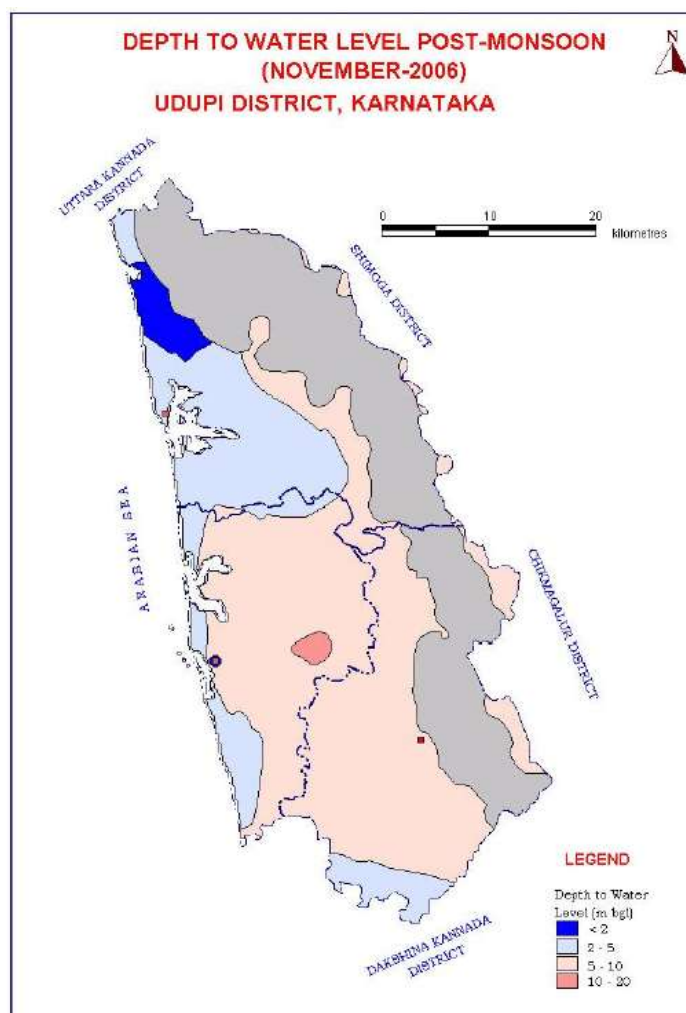


Figure 4-28 Depth to Water level Post monsoon, Udupi District,

Source: Central Ground Water Board-2008

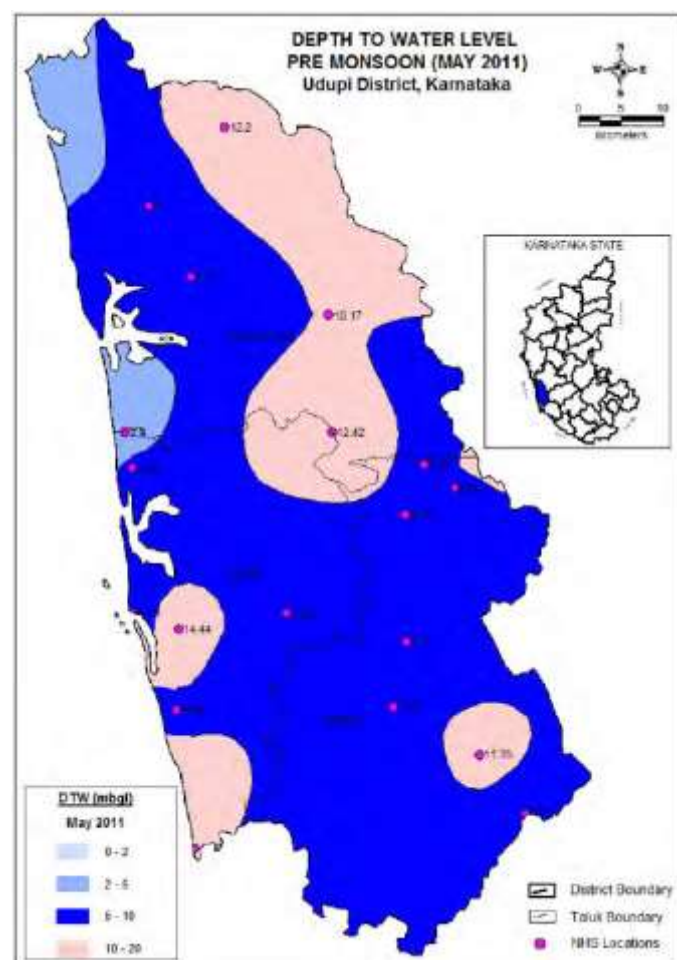


Figure 4-30 Depth to Water level Pre, Udupi District

Source: Central Ground Water Board-2012

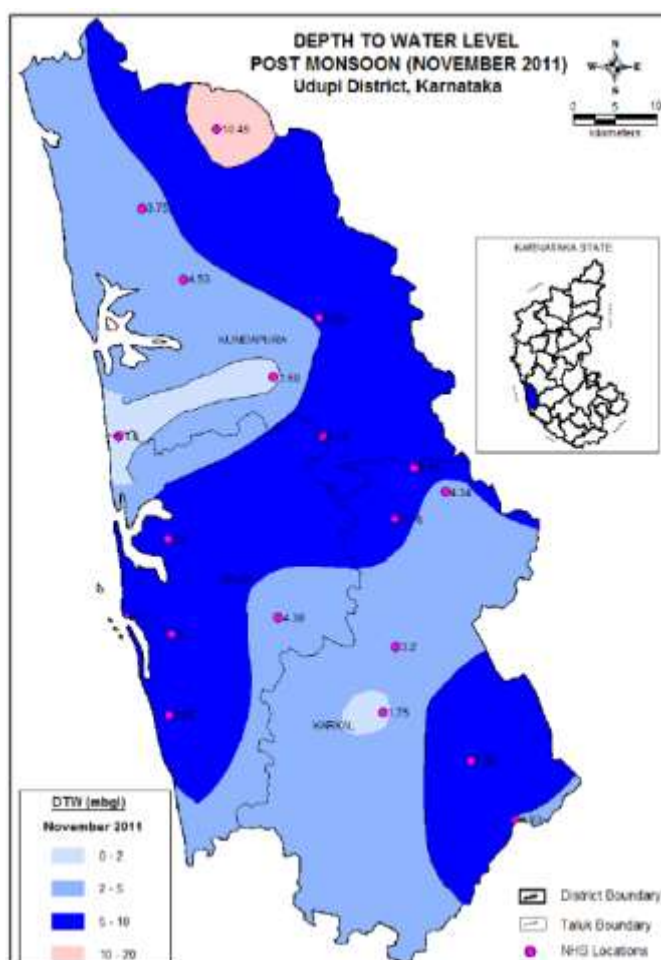


Figure 4-29 Depth to Water level Post monsoon, Udupi District,

Source: Central Ground Water Board-2012

For Statistical Data on Ground Water Table refer 10.4 Annexure IV – Wetlands

4.9 Coastal Regulations

Uppunda River joins the Arabian Sea Stretch. Along the coast, area covered under reserved forest is classified as CRZ-I and rest of the area is covered under CRZ-III. Uppunda is a high-density low risk zone with 200 dwelling per sq.km. But

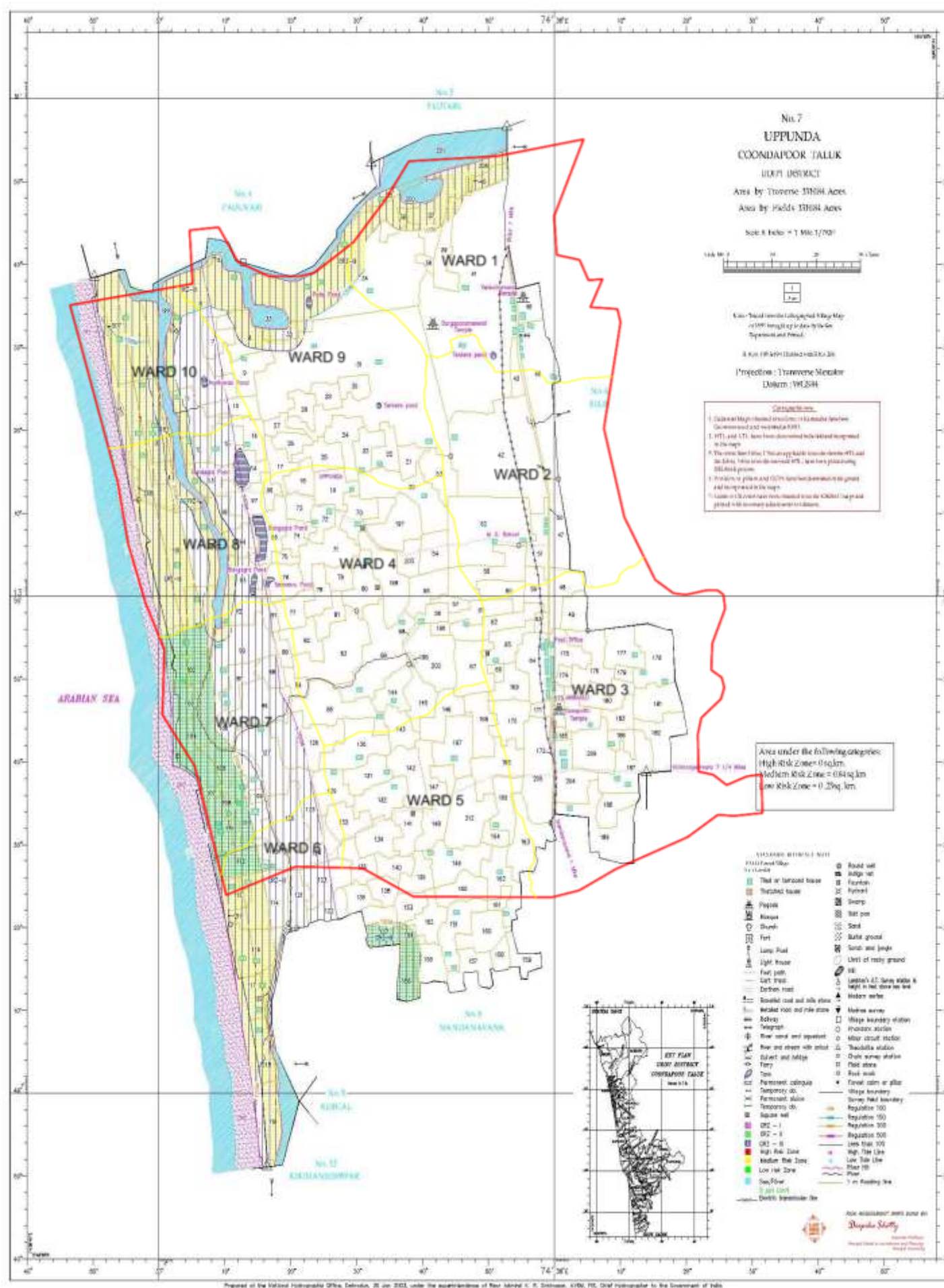


in CRZ area it is 498 units per sq. km. So in CRZ area scope of further construction is not there. The new construction can come on the eastern side of the G.P which is near the highway. Uppunda is oriented north-northwest (NNW) and south-southeast (SSE). The Baindur and the Yadamavina rivers join the Arabian Sea in this coastal stretch. The Baindur River has a catchment of 99 km² and the Yadamavina River has catchment size of 85 km². There are two spits: one grows southward across the Yadamavina River and the other grows northward across the Baindur River. These form a diverging spit system. There are 8.2 km separating the distal ends of these spits and 4 km of mainland coast between these spits. The coast is characterized by features such as islands and submerged rock bodies, headlands jutting into the sea, and drowned valleys. (Deepika shetty, 2012)

As per the shore line data, Uppunda area has artificial and stable coast with low accretion. Therefore, prevention of the spit growth and checking the growth rate of the spit is considered a viable means of coastal zone management under the circumstances.

Costal Regulation Zone (CRZ) in uppunda.

- Uppunda is a high-density low risk zone with 200 dwelling per sq.km. But in CRZ area it is 498 units per sq. km. So in CRZ area scope of further construction is not there. The new construction can come on the eastern side of the G.P.
- As per the Norms for regulation of activities under CRZ, in CRZ-I No new construction shall be permitted. CRZ-III, Areas up to 200 metres from the HTL have to be earmarked as a 'No Development Zone'. Agriculture, horticulture, gardens, pastures, parks, play fields are permissible.
- Area between 200 and 500 metres of the HTL in designated areas of CRZ-III can be developed with prior approval from the Ministry of Environment and Forests (MEF).
- In the case of Uppunda, ward 6,7,8,9,10 ,1 falls under crz. Out of which ward 7 is in low risk zone.
- As per the shore line data, Uppunda area has artificial and stable coast with low accretion. Therefore, prevention of the spit growth and checking the growth rate of the spit is considered a viable means of coastal zone management under the circumstance.





Water rise at



Water rise at



Water rise at

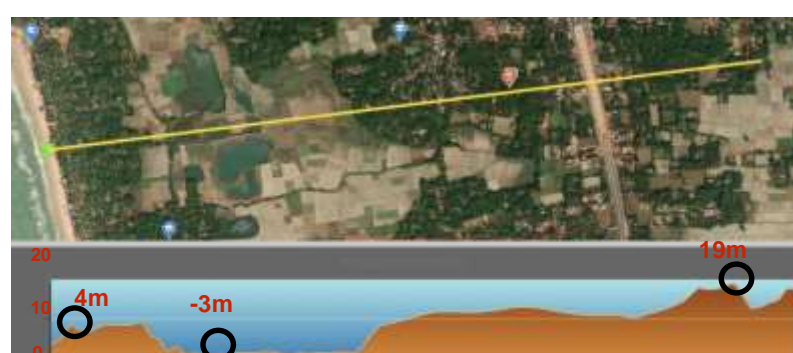
Figure 4-32 Flood Impact Maps, Source: 2012 Crz report on Uppunda, Deepika shetty



Map showing Wards & section line of



Ward 8,4,2
Section B



Ward 6,5,3

Section A



Ward 10,9,1

Section C

Figure 4-33 Schematic Sections,

Source: Google Earth

Issues

- On comparing all three maps, we can see that ward 9, 5, 4 are the lowest lying area. This area act as a catchment for the village due to which there is stagnation of water on roads, salination, etc.
- Sea Water intrusion leads to reduction of sweet water as ocean water approaches deep inland during flood.
- Salination of water is a major issue in this gram panchayat.
- Ward 9 and 10 is affected by salt water as fish farming is majorly practiced in these wards.
- Houses on wards 4, 5 and 9 are most affected as these lies in the low-lying area of the village.
- Paddy cannot be grown post rainy season due to less availability of water from agriculture.

- Canals running through ward 8 and 10 gets salty due to sea water intrusion and further leads to soil erosion due to lack of maintenance of embankments.

Recommendations

- Protection of natural ecosystem of breeding during non-fishing season
- As rice is majorly consumed and depends on wetlands to grow, these low lying areas could be used for rice cultivation even in dry season. These wards should contain maximum agricultural land.
- Proper storm water drainage is highly required in these wards to reduce the water logging. Harvesting of storm water is also recommended.
- Protection of natural drainage and wetlands is needed.

4.10.1 Wetlands

Wetlands are one of the crucial natural resources. Wetlands are areas of land that are either temporarily or permanently covered by water. This means that a wetland is neither truly aquatic nor terrestrial; it is possible that wetlands can be both at the same time depending on seasonal variability. Thus, wetlands exhibit enormous diversity according to their genesis, geographical location, water regime and chemistry, dominant plants and soil or sediment characteristics. Because of their transitional nature, the boundaries of wetlands are often difficult to define. Wetlands do, however, share a few attributes common to all forms. Of these, hydrological structure (the dynamics of water supply, throughput, storage and loss) is most fundamental to the nature of a wetland system. It is the presence of water for a significant period of time which is principally responsible for the development of a wetland.

Wetlands support a large variety of plant and animal species adapted to fluctuating water levels, making the wetlands of critical ecological significance. Utility wise, wetlands directly and indirectly support millions of people in providing services such as food, fiber and raw materials, storm and flood control, clean water supply, scenic beauty and educational and recreational benefits. The Millennium Ecosystem Assessment estimates conservatively that wetlands cover seven percent of the earth's surface and deliver 45% of the world's natural productivity and ecosystem services of which the benefits are estimated at \$20 trillion a year (Source : www.MAweb.org).

Wetland is a major issue in coastal areas. Situation of wetlands in context to Uppunda can be referred to 10.5 Annexure V (Wetlands of Udupi District)

4.11 Earthquake Risk Assessment

Forming the western mountainous part of the DC, the Sahyadri encompasses the NNW–SSE ending *en echelon* ranges that abruptly end as steep slope-breaks at their northwestern ends and as very high scarps that face west. It has been described as an example of a retreating rift-flank. The Western Ghats escarpment is not straight or curved, but characterized by *en echelon* pattern of slope-breaks and scarps. The mountainous terrain is cut by a multiplicity of predominant NNW-SSE trending *en echelon* sinistral faults and less common ESE/E–WNW/W oriented shear zones. West of the more-than-700 m high escarpment lies the Coastal Belt of an undulating terrain, characterized by low ridges and shallow depressions that have approximately NNW–SSE trend and by a thick mantle of laterite. The elevation of this erosion surface (coastal belt) varies from 40 to 120 m above sea level. Lithologically and structurally the Coastal Belt is not different from the mountainous Sahyadri. However, the altitudinal contrast is very great and the change of elevation is quite abrupt. Interestingly, the geological, geomorphological and tide-gauge data near Mangalore on the coast (13°N) confirm earlier studies that this coastal tract has been rising at the rate of 1.95- 0.14 mm/yr. and 3.22- 1.1 mm/yr. relative to the areas, respectively to the north and the south. Significantly, these three areas (of observation) lie on three different NNW–SSE trending fault-delimited low ridges. It may therefore be inferred that these three linear blocks have different rates of uplift. This can happen only if the faults that delimit them are active to different degrees.

The current rates of uplift indicated by tide-gauge data (= 3 mm/yr.) and spirit-level data (= 6 mm/yr.) are higher than the Quaternary rates and are consistent with the recent strain (< 10 Nano strain/yr.) measured geodetically in southern India.

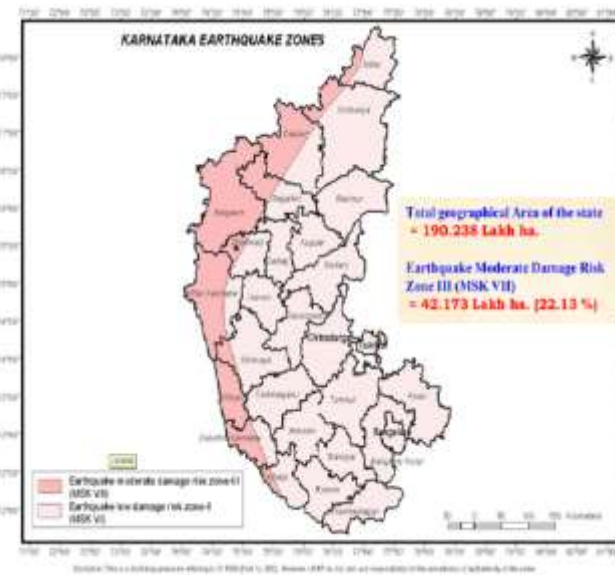


Figure 4.30 zoning of risk assessment (from gazetteer 2011) and prominent fault lines

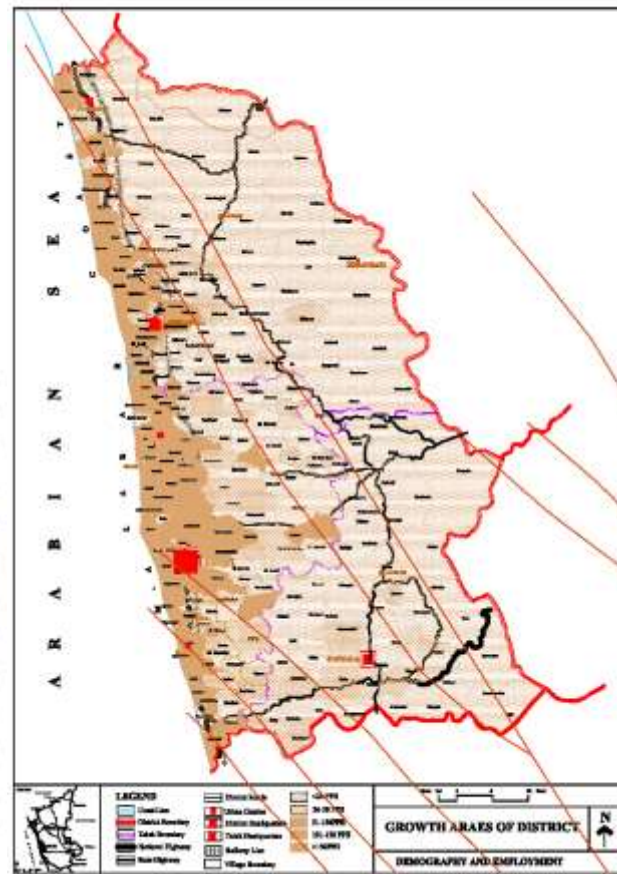


Figure 4.31 Map of Udupi district with population density and prominent fault



Figure 4.32 Recorded earthquakes and their magnitude lines

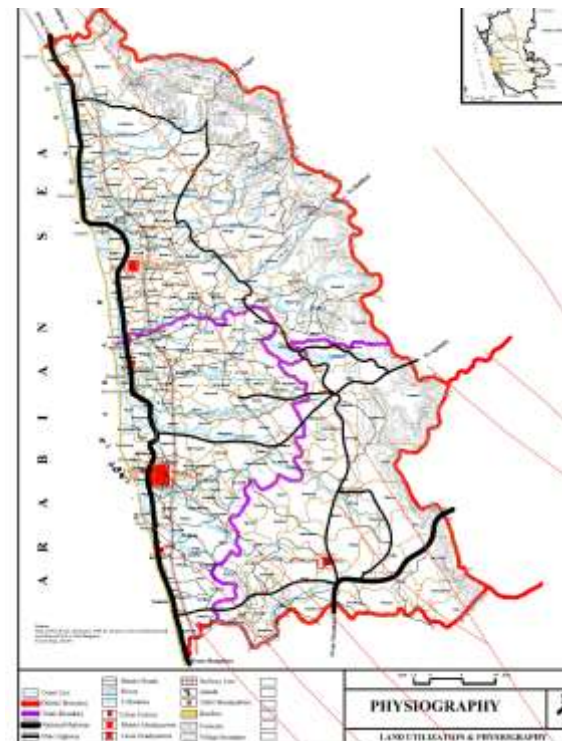


Figure 4.33 Physiography and transport network superimposed on fault lines

4.12 Beach profile and volume change

During the pre-monsoon season, storm waves start. The portion of the spit closest to the river mouth in both the Baindur and the Uppunda spits experienced accretion while the portion of spit far from river experienced erosion. During southwest monsoon erosion occurred both in the Baindur and Uppunda spits. In general, the Baindur spit experienced more erosion, particularly in the part close to the river mouth. The Uppunda spit experienced more erosion in the mainland of the spit.

During the post-monsoon season, both showed deposition. However, there was spatial variation in the mode of accretion. In the Baindur spit, the lower foreshore experienced accretion while in the Uppunda spit, the lower foreshore experienced erosion while the upper foreshore experienced accretion. (Hegde, et al., J Coast Zone Manag 2015, 18:2)

4.13 Flora and Fauna

The backwaters of gangoli estuaries support a rich vegetation of mangroves (50ha). These mangroves provide niche for birds and support the local human population in providing food, fodder and fuel wood. The major fish catch composition include sharks, shrimps, skates, prawns, crabs etc. Cashew, coconut, jackfruit, banana are the common plantation observed in the area.

(http://wgbis.ces.iisc.ernet.in/energy/water/proceed/proceedings_text/section3/paper1/section3paper1.htm#REF). Being on the coast line lot of bird species have been identified some of which are Sandplovers, kentish plovers, sanderlings etc. Hoode beach, mattu beach and pithrodi beach are the secluded beaches where migratory birds can be seen.



Figure 4.34 Sandplover Source: Google images



Figure 4.35 Kentish Plover source: Google images



Figure 4.36 Cashew Tree Source: Google images



Figure 4.37 Coconut TreeTree Source: Google images

(<https://jirexlore.com/explore/unexplored-areas/birding-around-udupi>)



5. Inventory and Analysis of Natural Resources using Geospatial Technologies

Chapter from NRSC/ ISRO

5.1. Introduction

For any nation, effective utilization of natural resources and their management are extremely essential. Hence, there is a need to catalyze the planning process at grassroots level. Land is a limited resource and has pressure from social, economic and environmental needs, including urbanization, industrialization, mining, transportation, rural development, protection of environmentally sensitive zones and resource areas. Unplanned development in rural, peri-urban areas and that in the vicinity of national and state highways also has adverse social, environmental and health hazards. Spatial planning in rural areas is of paramount importance in order to have well-designed rural communities, as well as scientific and orderly disposition of land resource. This would in turn, foster economic development and contribute to the ease of living along with improvement in the quality of life.

Developmental planning is a complex process of decision making based on the information about the status of resources, socio-economic conditions and institutional constraints. Reliability of the databases, both the spatial and non-spatial, is therefore crucial to the success of the developmental planning. Hence, it is necessary to understand various elements of Gram Panchayat and their interrelationship for ecological planning.

The conventional techniques employed to provide spatial information on natural resources are highly tedious, time consuming and more often subjective; whereas satellite remote sensing with synoptic and regular coverage has the requisite potential to provide up to date information in a timely and more objective manner. Remote sensing (RS), Geographic Information System (GIS) and Global Positioning System (GPS) constituting the emerging field of geospatial technology offer great promise for generating spatial information on natural resources at national and subsequent disaggregated levels. With advancements in space technology, availability of high resolution data and advanced processing techniques, the remote sensing technique has become a powerful tool for mapping and monitoring of natural resources. These techniques have immense potential for providing spatial information on natural resources resource mapping and monitoring at regular intervals.

GIS is a powerful tool for integrating natural resources for development of spatial decision support systems. Thus, geospatial technology along with Information and Communication technology (ICT) has become a very useful technique and powerful tool for providing spatial information including development of land use information systems, towards decision making. Further, the system is also highly useful for updating and monitoring the dynamics of land use changes through the monitoring capabilities of the multi-temporal remote sensing data. Remote Sensing in conjunction with Geographical Information System (GIS) and other IT tools is also emerging as flexible, efficient, speedy, cost-effective and reliable technology for obtaining information on natural resources analysis and modeling. It is an integral part of data management in large number of applications. Spatial information - images and maps, forms the foundation and basis for the most planning and implementation of developmental activities; infrastructure development; disaster management support; environmental monitoring; natural resources management and many other national activities. Over the last two decades remote sensing and GIS have been widely used for the preparation of different types of thematic layers and integrating them for different applications that include land and water resources planning, agricultural applications, water resource management, disaster management, forestry applications, watershed management and urban applications etc.

The present study focuses on the inventory and analysis of natural resources for Uppunda Gram Panchayat in Byndoor taluk, Udupi district, Karnataka (Figure 5.1). Uppunda Gram Panchayat is one among the 32 pilot GPs identified under the GPSDP project initiated by MoPR, Govt. of India.

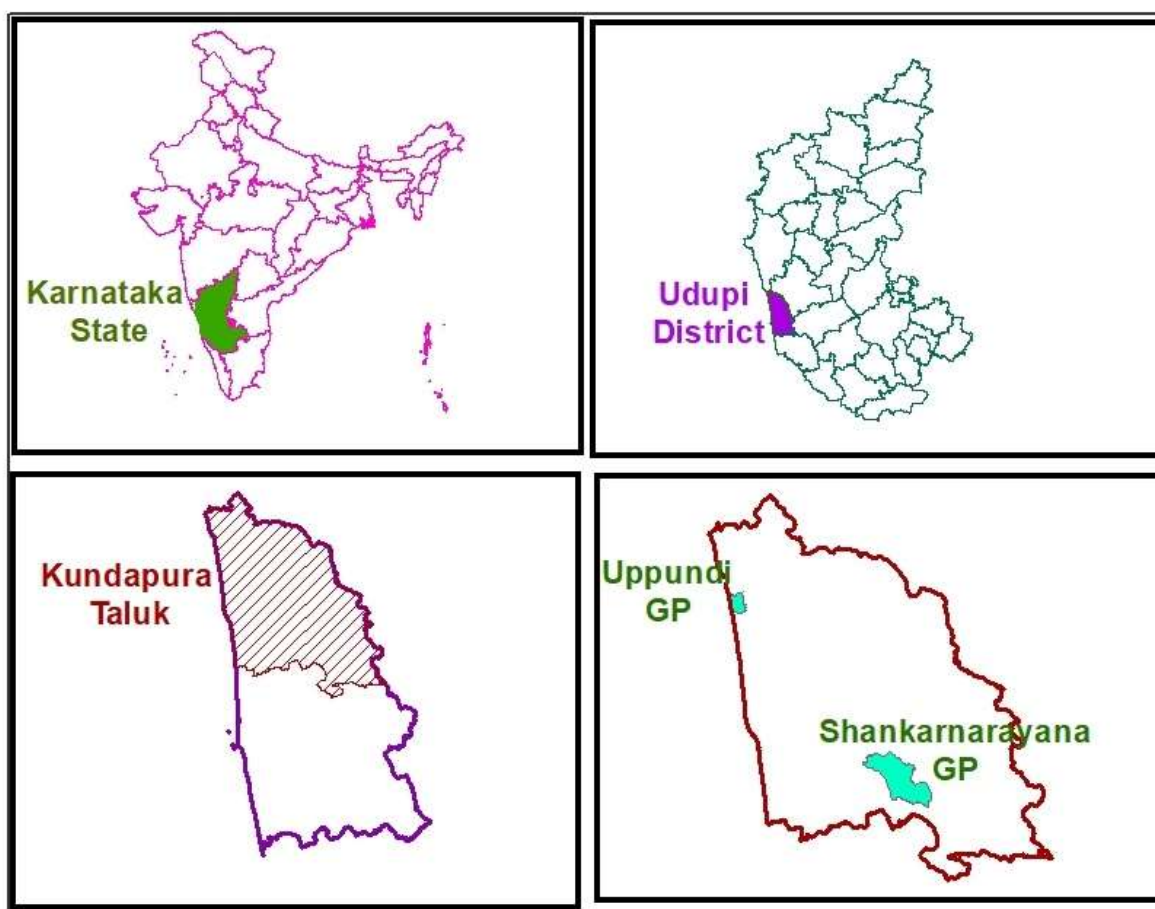


Figure 5-1 Study area location map for pilot GPs of Karnataka under GPSDP

5.2. Objectives

As the information on natural resources of a region is crucial to any planning process, the present study was taken up with the following objectives:

- i. Providing very high resolution, high resolution and medium resolution satellite datasets along with natural resources information in the form of thematic layers viz., infrastructure layers, LU/LC, slope, drainage network & water bodies, contours, soil etc.
- ii. Analysis of rain-fall and run-off estimation
- iii. Generation of Land and Water resource development plans

5.3. Inventory of Natural Resources using High Resolution Satellite Data

Potential tools such as remote sensing and GIS techniques are utilized for generation of various thematic resource maps in conjunction with collateral data. Data integration and generation of development plans are carried out in Geographic Information System environment.

5.3.1. Satellite datasets / Thematic database for developmental planning

Satellite data from CARTOSAT-1, IRS P6 LISS-IV, IRS-1D LISS III datasets and other collateral data form major source for preparation of various thematic maps as spatial database. The data acquired from the multi-spectral sensors LISS IV (5.8 m resolution) and CARTOSAT-1 (2.5 m resolution) of the Indian Remote Sensing Satellite (IRS) series are extensively used for generating spatial databases. Very high-resolution satellite data (CARTOSAT-2S & KOMPSAT-3A) is analyzed at finer resolutions to update the spatial layers needed for generating the value-added Land resource and water resource development plans. The data needed for this study is studied in detail and the collected primary maps have been grouped into hydro-geomorphological, topographical, land use/land cover, hydrology and socio-economic parameters (Table 3.1.a). Subsequently, these primary maps are used to produce utilitarian types of maps to serve planning decisions. They are derived, in some cases, by direct translation of single thematic map and in others by combination of two or more thematic maps or chosen parameters of the different themes (Table 3.1.b). Natural resources data representing environmental status of the study area that were generated under various national level projects at 1:50,000 scale was considered for the present study and are presented below. The database was standardized for integrated analysis under GIS environment.

**Table 5-1: Information sources for development planning**

Data/map	Source	Spatial/Non-spatial	Scale
Digital Elevation Model	CARTOSAT Stereo data	Spatial	10 m
Contour	CARTODEM	Spatial	5m
Geological map	Rajiv Gandhi National Drinking Water Mission, NRSC	Spatial	1:50K
Geomorphological map		Spatial	1:50K
Structures/Lineaments		Spatial	1:50K
Soil Texture	NRIS, NRSC	Spatial	1:50K
Ground water potential map	NRSC	Spatial	1:50K
Ground water quality borewell location map	NRSC	Spatial	1:50K
Land use/ Land cover	Very high-resolution data	Spatial	1:4K
Drainage map and Surface water bodies	Very High resolution satellite data	Spatial	1:4K
Meteorological data	IMD	Spatial	25 km grid
Settlement	Very high-resolution data	Spatial	1:4K
Infrastructure	High resolution satellite data	Spatial	1:4K
Gram Panchayat boundary	NIC	Spatial	1:50K
Village boundaries	NRSC	Spatial	1:50K

Table 5-2 Derived spatial databases required for planning

Derived map	Theme map	Remarks
Contour/Slope	Topographical map / CARTOSAT-1 PAN stereo data	Derived from DEM
Groundwater potential	Geology, Geomorphology, borewell, Lithology and yield data	Updation using present ground information
Water Resource Development Plan	Slope, soil map, land use, drainage order, lineament, Runoff Potential	Multi Criteria analysis
Land Resource Development Plan	Slope, soil map, land use, Ground Water Potential, Geomorphology	Multi Criteria analysis

5.4. Satellite Data Used

High resolution (2.5m), very high resolution (0.7m) satellite datasets and Digital Elevation Model (DEM) were used for preparation of spatial thematic layers for Uppunda GP

5.4.1. High Resolution Satellite Data (HRS data)

Merged product of CARTOSAT-1 PAN and IRS LISS-IV Mx datasets acquired during 2015-16, from SIS-DP Phase-II in Natural Color Composite i.e. NCC mode of 2.5m spatial resolution was used for GPSDP planning (Figure 5-2.).

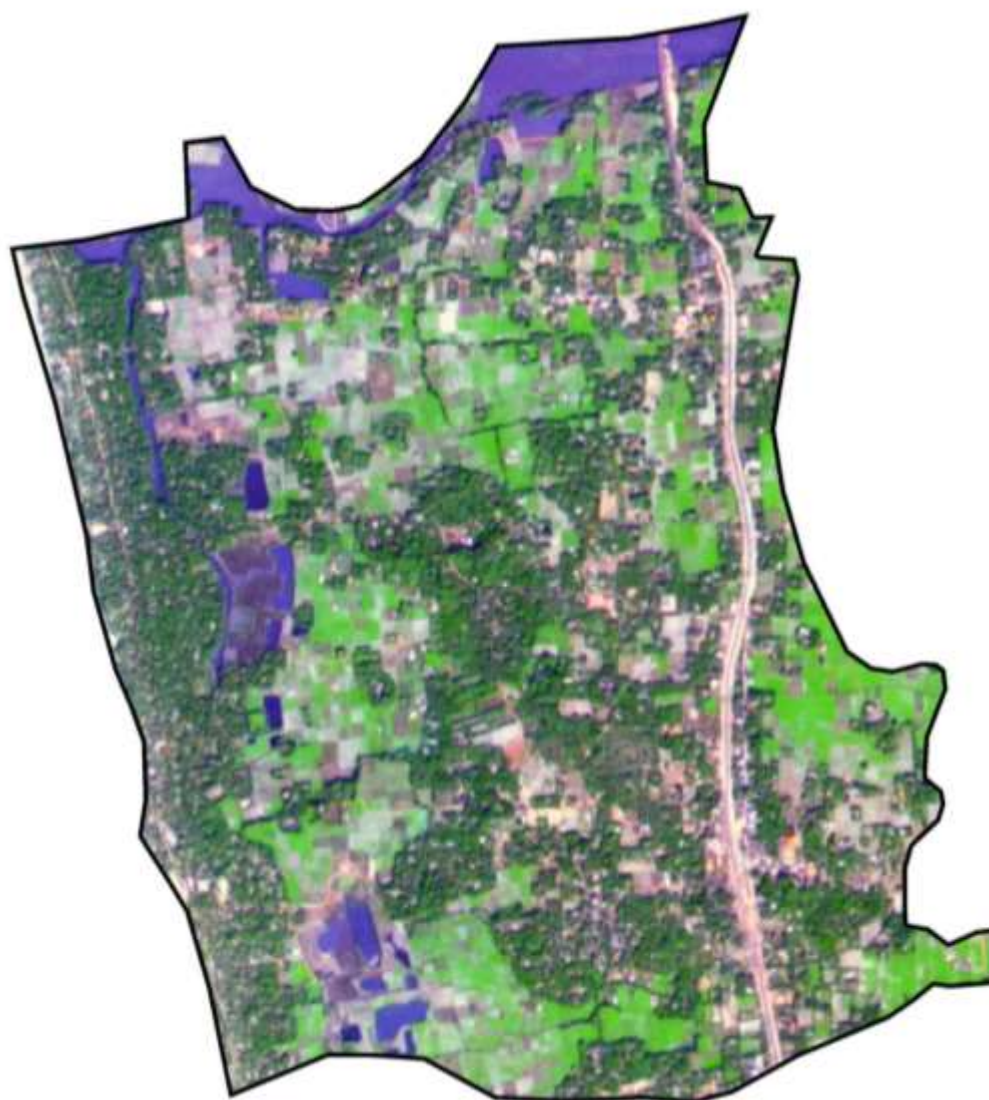


Figure 5-2 Uppunda GP as seen through HRS data in NCC mode (2.5m)

5.4.2. Very High-Resolution Satellite Data (VHRS data)

Resource mapping at 1:4,000 scale was carried out using VHRS data at sub-meter resolution specially acquired for this project using KOMPSAT-3 sensor (optical high-resolution Korean observation mission of Korea Aerospace Research Institute). KOMPSAT-3A provides panchromatic resolution of 0.55m and multispectral resolution of 2.2 m and has an infrared sensor at 5.5m resolution. The merged product is generated with spatial resolution of 0.7m in False Colour Composite i.e. FCC mode (Figure 5-3).

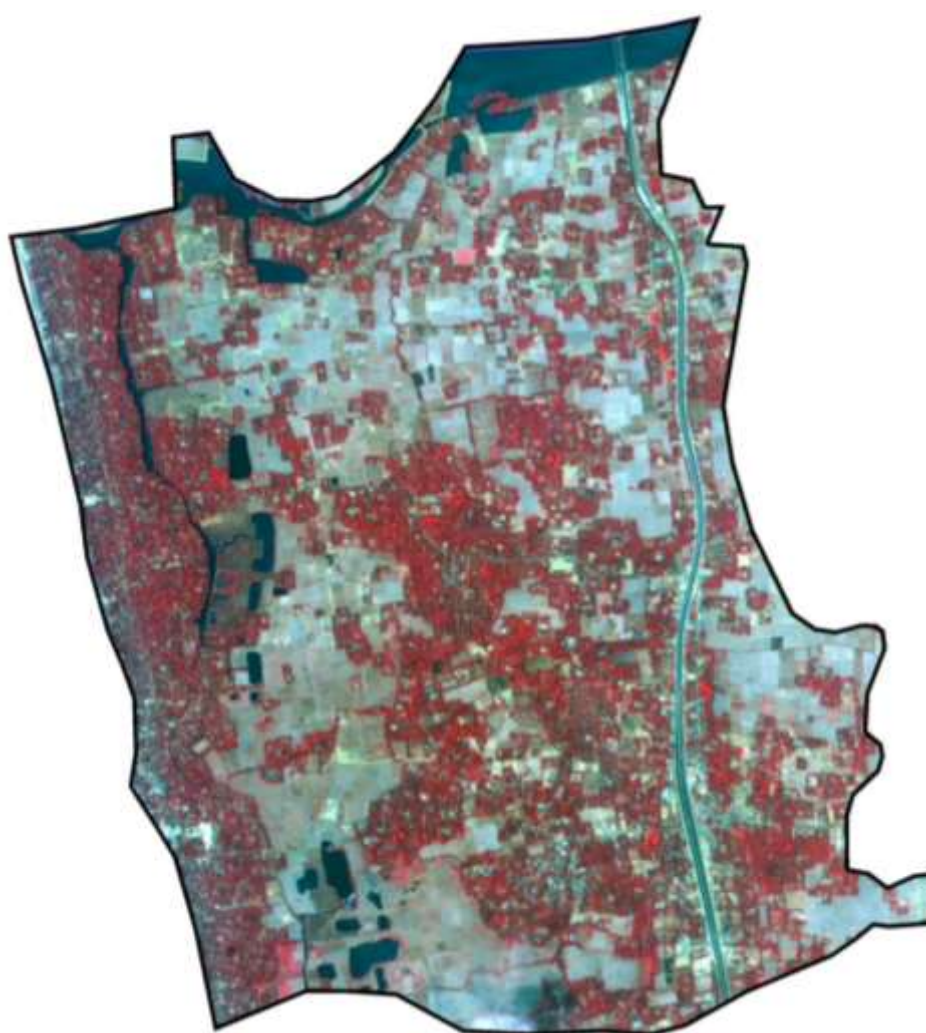


Figure 5-3 Uppunda GP as seen through VHRS data in FCC mode (0.7m)



5.4.3. Digital Elevation Model (DEM)

DEM is one of the important parameters for developmental activities and was derived from CARTOSAT-1 stereo data. The elevation data is very much essential for generation of slope and contour maps, which are essential requisites for spatial planning purposes. DEM of the study area is shown as Figure 5.4.

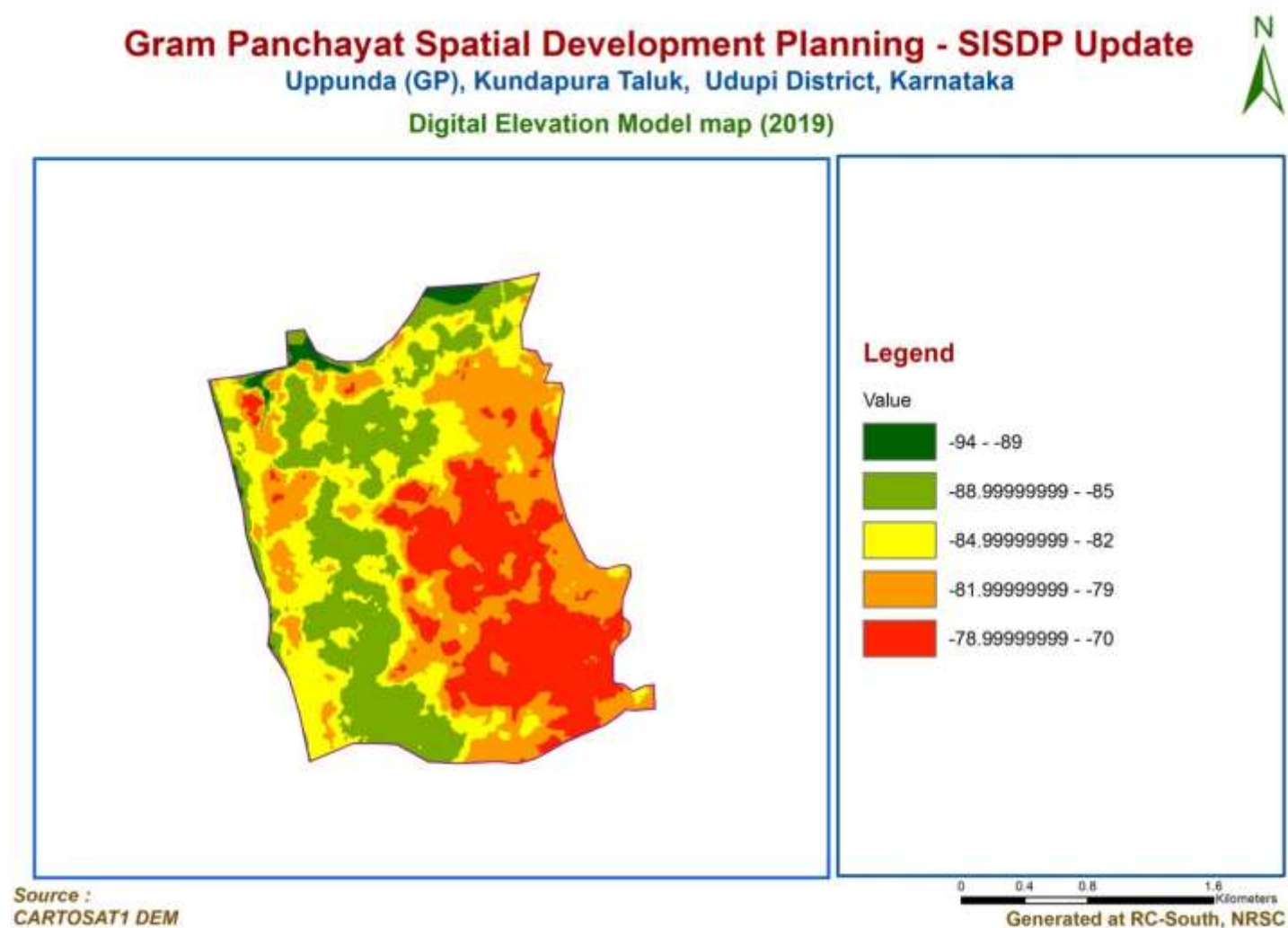


Figure 5-4 Digital Elevation Model of Uppunda

5.5. Spatial Layers

Spatial layers representing the synoptic view of GP were generated at 1:4,000 and 1: 10,000 scales.

5.5.1. Settlement and Transportation Layer

For Uppunda GP, Settlement and Transportation Layer generated using VHRS data at sub-meter resolution at 1: 4,000 scale (Figure 5.1). The statistics of road types and Settlement categories are given in Tables 5.1a and 5.1.b respectively. Rural settlement growth in different directions can be analyzed using satellite data more explicitly

Table 5-3 Road length for different Road categories in Uppunda GP

S.No.	ROAD CATEGORY	ROAD LENGTH (KM)
1	National Highway	3.03
2	Service Road	3.39
3	Village Road	25.14
	TOTAL	31.56

Table 5-4: Areal spread of different Settlement categories in Uppunda GP

S. No.	Settlement CATEGORY	Area (ha)
1	Hamlet & Dispersed Household (HD)	4.29
2	Mixed Village Settlement (MV)	36.17
3	Village Settlement (VS)	86.03
	<i>Sub-total</i>	<i>126.49</i>

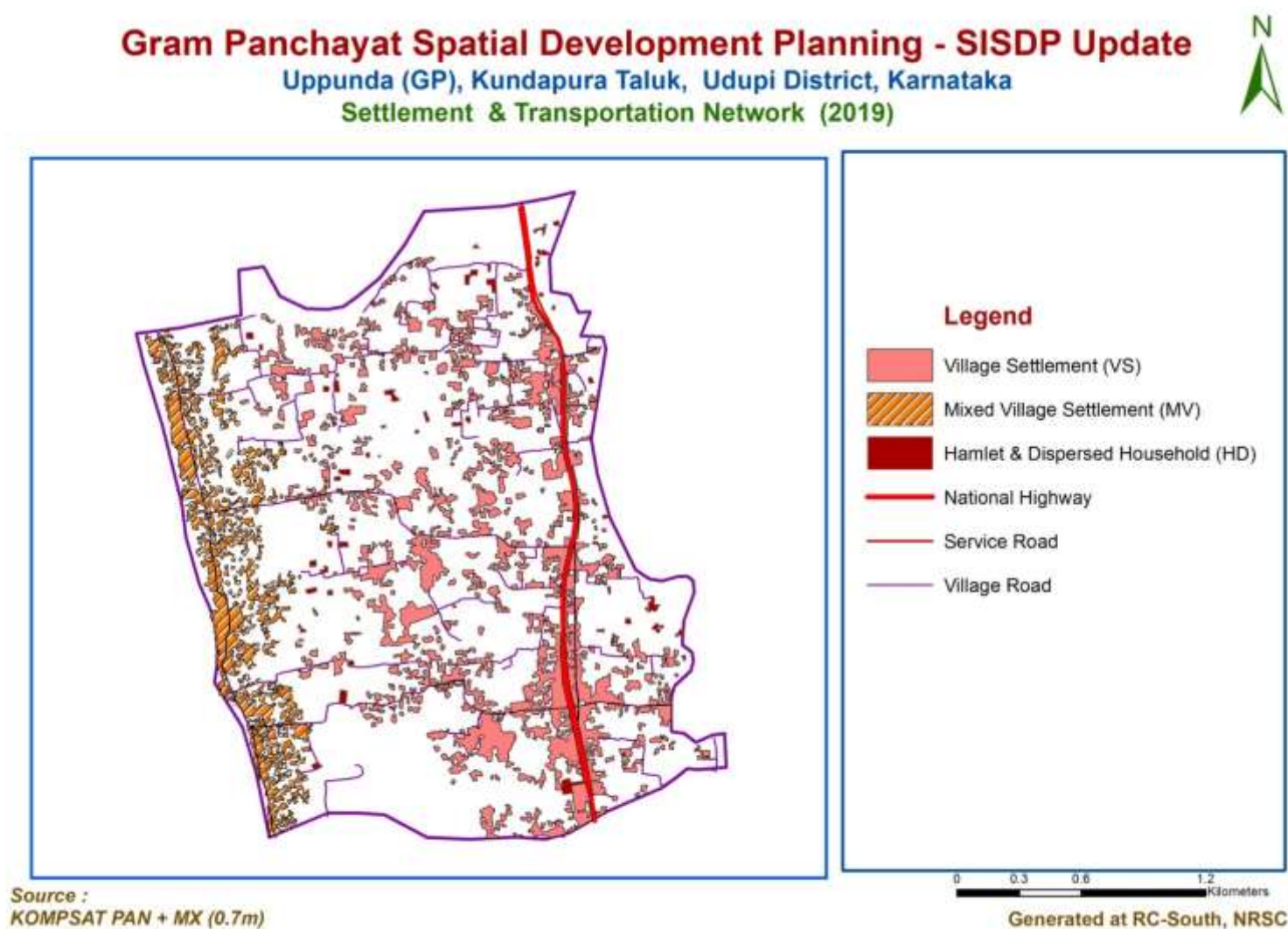


Figure 5-5: Settlement and Transportation Network of Uppunda GP

5.5.2. Land Use Land Cover Map (1:4,000 scale)

Very high resolution, sub-meter satellite imagery from KOMPSAT-3 sensor (DOP: 01 April, 2019) of 0.7m spatial resolution was utilized for preparation of detailed Land Use / Land Cover (LULC) map of Uppunda GP. 0.7m merged satellite data was formed by data fusion of panchromatic image (0.7m) and multispectral image (2.8m) in FCC mode, both from KOMPSAT-3. Onscreen visual interpretation technique was adopted in GIS environment for delineating boundaries of various classes using ArcMap 10.5 software. The merged satellite image was zoomed up to 1:1,500 scale to delineate the feature boundaries. The final LULC map was prepared at 1:4,000 scale (Figure 5.6). Area estimates of various LULC classes in Uppunda GP are summarized in Table 5.-5. Overall, the GP area was divided into 5 major classes, namely, cropland, agricultural plantations, settlement, wasteland, water and other land use / land cover classes. These classes were further subdivided into sub-classes as indicated in Table 5.5. Majority of the area under Uppunda GP is under cropland (207.59 ha), followed by agricultural plantations/orchards, mainly coconut (184.78 ha). These two classes cover about two-thirds of the entire GP area (67%). The settlement / built-up area in the GP covered about 126.49 ha, which was further delineated as village settlement (86.03 ha), mixed village settlement (36.17 ha) and hamlet & dispersed household (4.29 ha). Wastelands occupied 18.99 ha area, comprising of sparse scrub land (3.92 ha), waterlogged area (5.65 ha) and costal sandy area (9.42 ha). Water bodies covered an area of 28.87 ha (21.42 ha by river and 7.45 ha by lake/pond). Other LULC classes covered the remaining area of 16.82 ha.



Table 5-5 Area estimates of various LULC classes in Uppunda GP (1:4k map)

S.No.	CLASS CATEGORY / NAME	AREA (ha)
A.	CROPLAND/AGRICULTURAL PLANTATIONS	
1	Crop Land (CL)	207.59
2	Agriculture Plantation / Orchards (AP)	184.78
Sub-total		392.37
B.	SETTLEMENTS	
3	Hamlet & Dispersed Household (HD)	4.29
4	Mixed Village Settlement (MV)	36.17
5	Village Settlement (VS)	86.03
Sub-total		126.49
C.	WASTELAND	
6	Sparse scrub land (SS)	3.92
7	Waterlogged (WL)	5.65
8	Sandy Area - Coastal (SC)	9.42
Sub-total		18.99
D.	WATER	
9	Lakes / Pond (LP)	7.45
10	River (RI)	21.42
Sub-total		28.87
E.	OTHERS	
11	Transport Network (TN)	10.26
12	Sea wall along the coast	0.90
13	Open areas along the coast	2.85
14	Open land next to highway	2.40
15	Aquaculture (AC)	0.41
Sub-total		16.82
TOTAL		583.54

Gram Panchayat Spatial Development Planning - SISDP Update

Uppunda (GP), Kundapura Taluk, Udupi District, Karnataka

Land use / Land cover (2019)

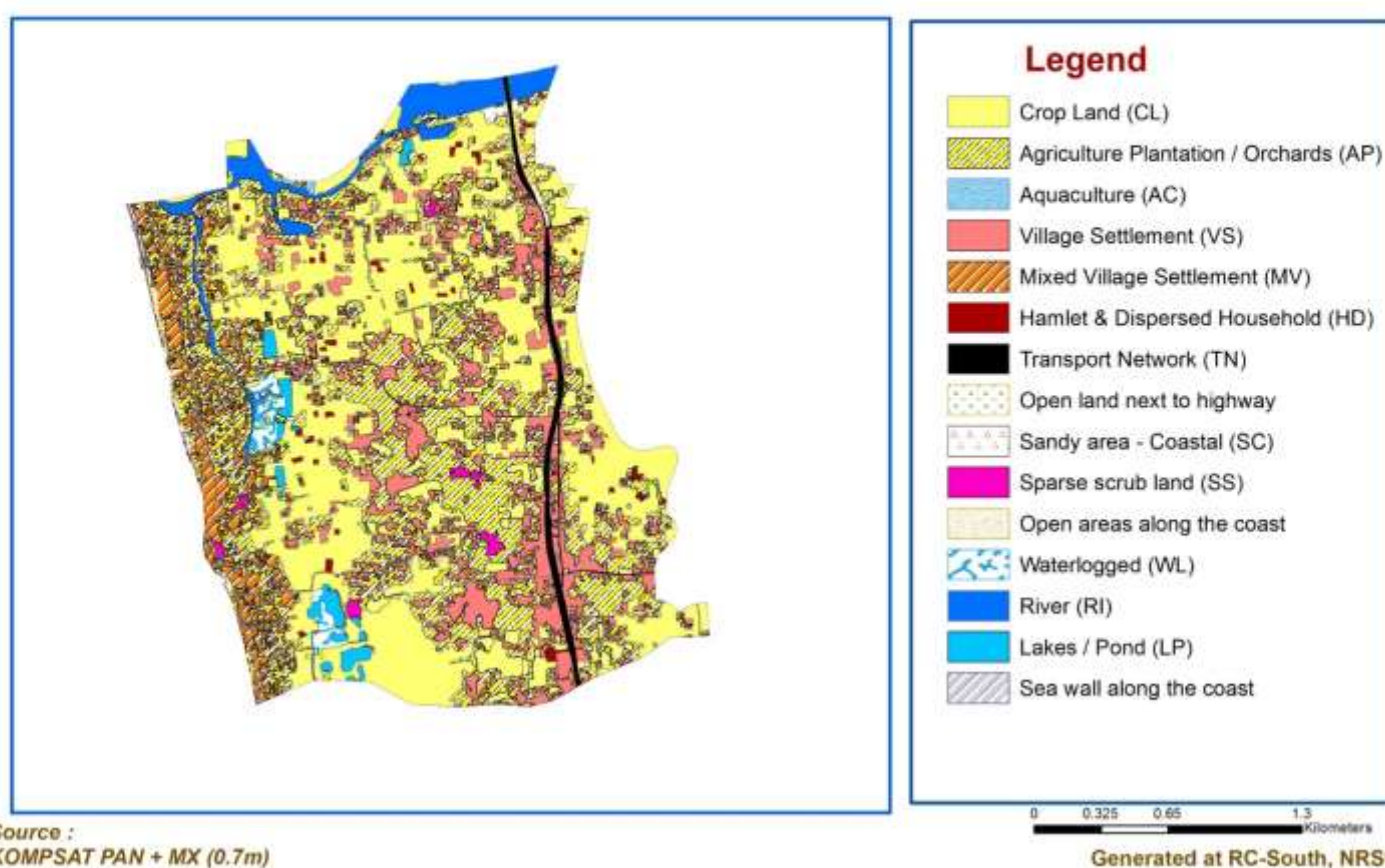


Figure 5-6 LULC map of Uppunda GP at 1:4k scale

5.5.3. Drainage network & surface water bodies

Rivers/streams are natural course of water flowing on the land surface along a definite channel and its spatial distribution in the GP is shown as Figure 5.7. The statistics of drain length are given in Table 5.6. Areal spread of Surface water bodies is given in Table 5.5.

Table 5-6 Statistics of drain length for Uppunda GP

S.No.	DRAIN CATEGORY	DRAIN LENGTH (KM)
1	River	3.39
2	Drain	8.80
	TOTAL	12.19

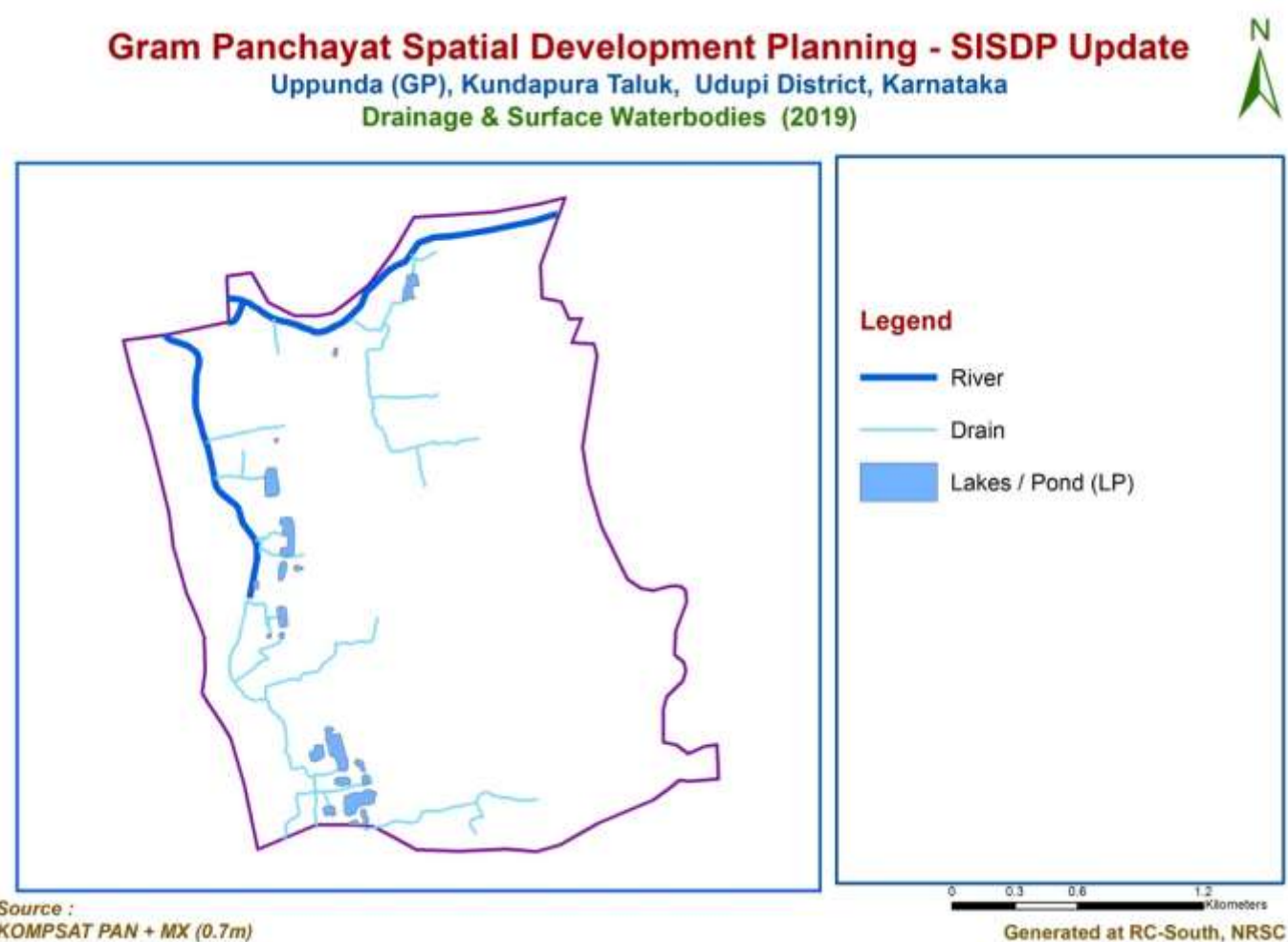


Figure 5-7 Drainage and surface water bodies of Uppunda GP

5.5.4. Slope Map

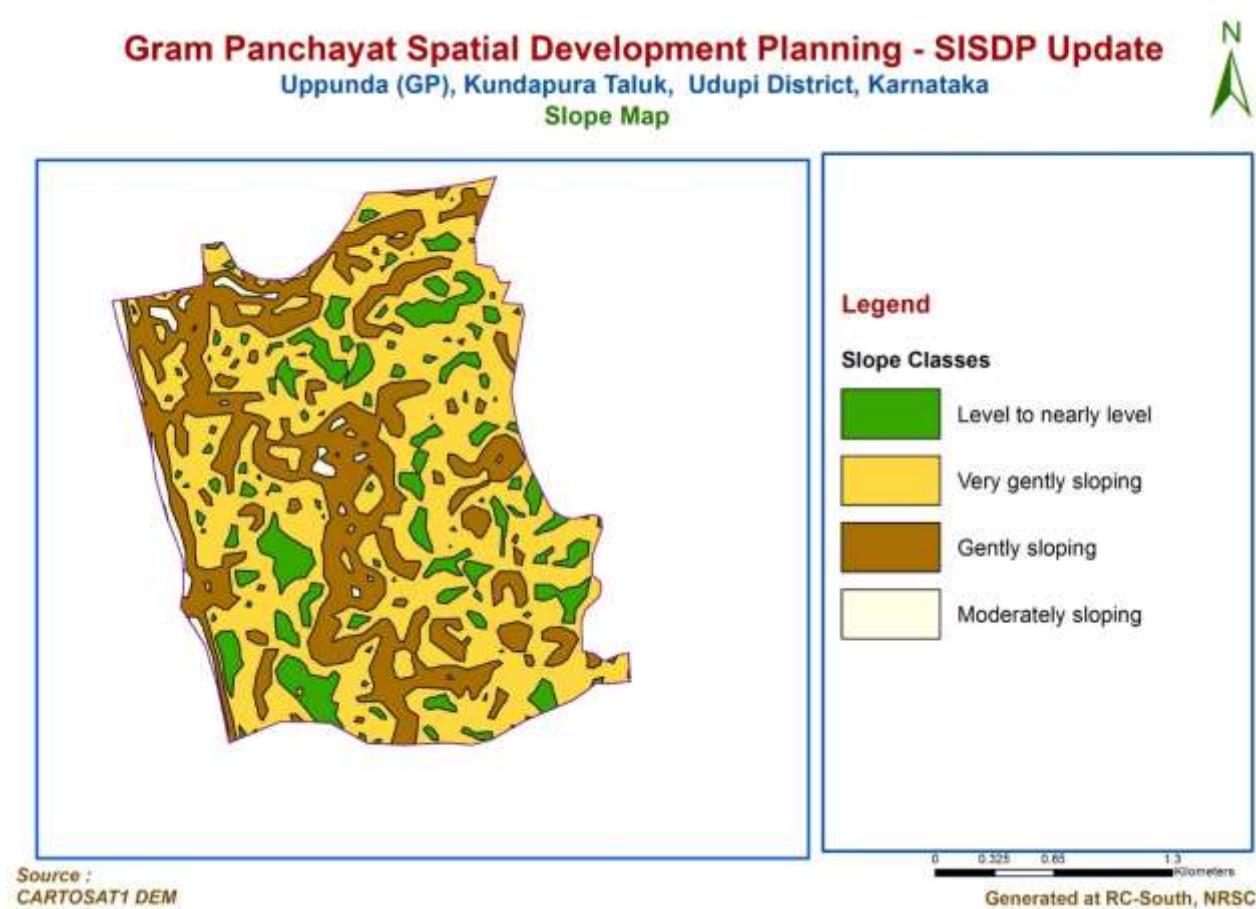


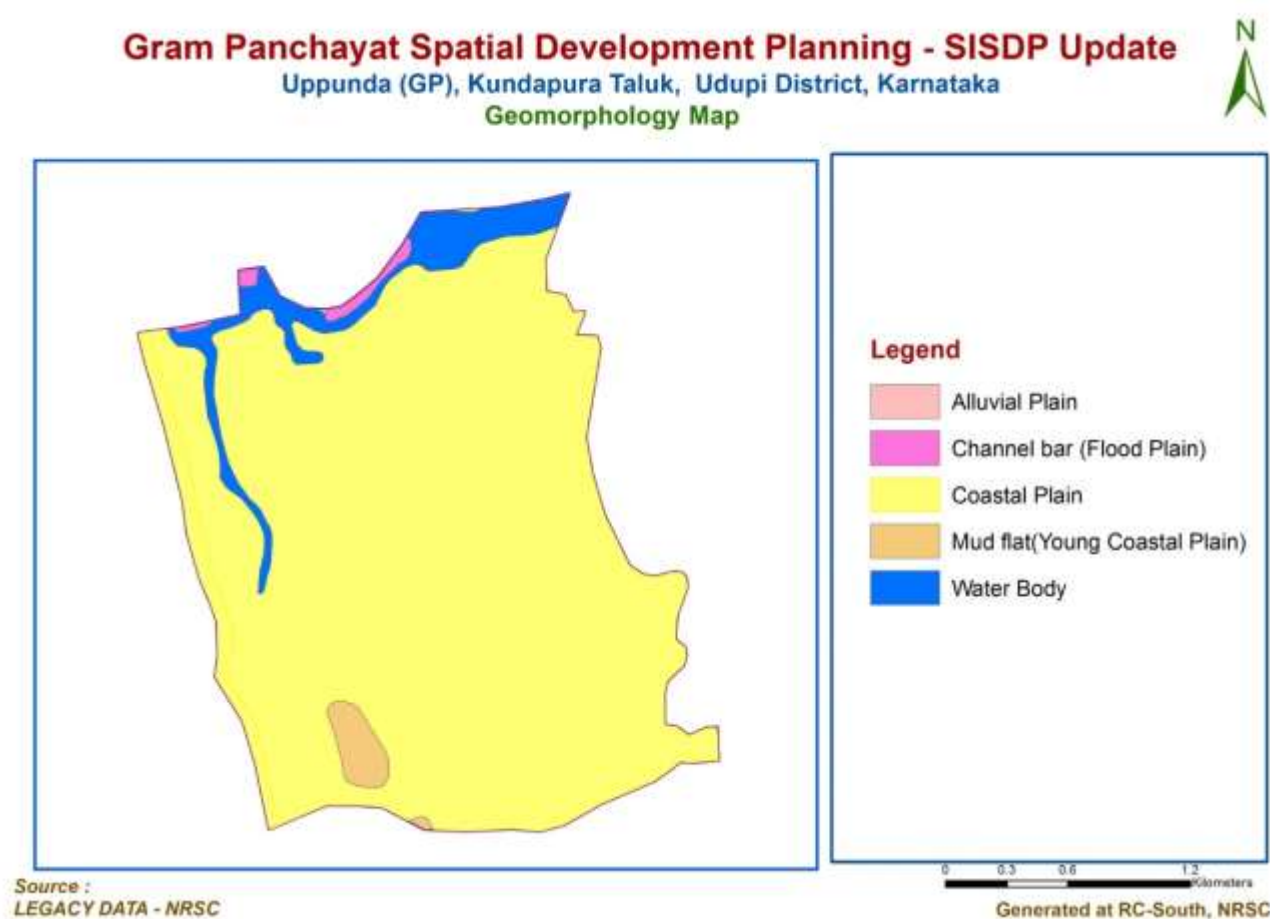
Figure 5-8 Slope map of uppunda GP



CARTODEM was used for generation of the slope layer and it plays an important role in developing the Land and Water Resource Development Plans (Figure 5.8).

5.5.5. Geomorphology Map

Hydro-geomorphological maps depict major geomorphic units, landforms and provide an understanding of the processes relating to groundwater occurrence as well as groundwater prospects. Geomorphological map was updated based on the



morphological expressions in the high resolution satellite data and other collateral data (Figure 5.9).

5.5.6. Soil Texture Map

Spatial distribution of soil texture in Uppunda GP is shown in Figure 5.10. Major soil texture classes present in Uppunda GP are sandy (near sea-shore), sandy loam (mainly in and around coastal region), sandy clay loam (covering majority of upper part of GP in NE, central & eastern regions) and clay loam (mainly towards lower half of the GP).

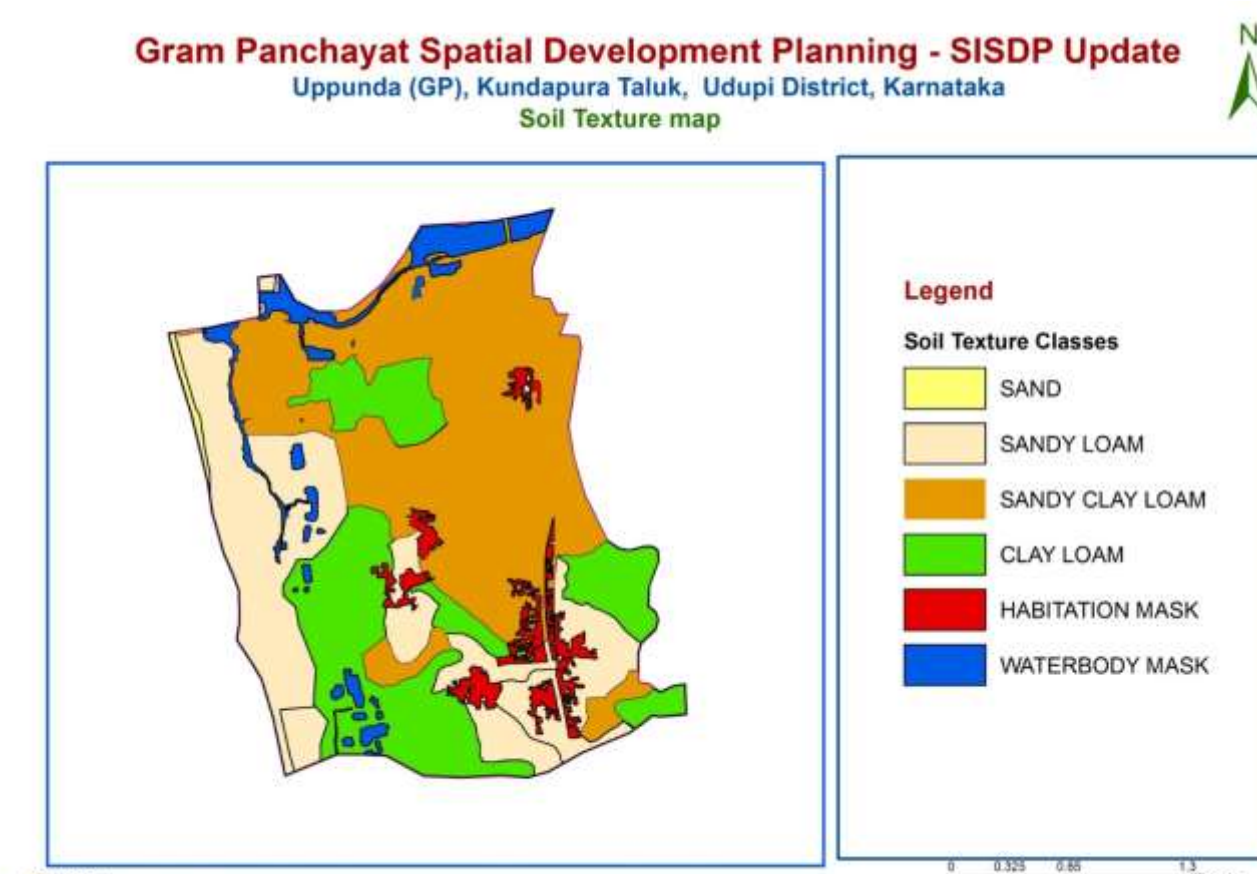


Figure 5-10 Figure 5-11 Soil texture map of Uppunda GP

5.5.7. Contour Map

Contours at 5m contour interval generated using CARTODEM are shown in Figure 5.11.

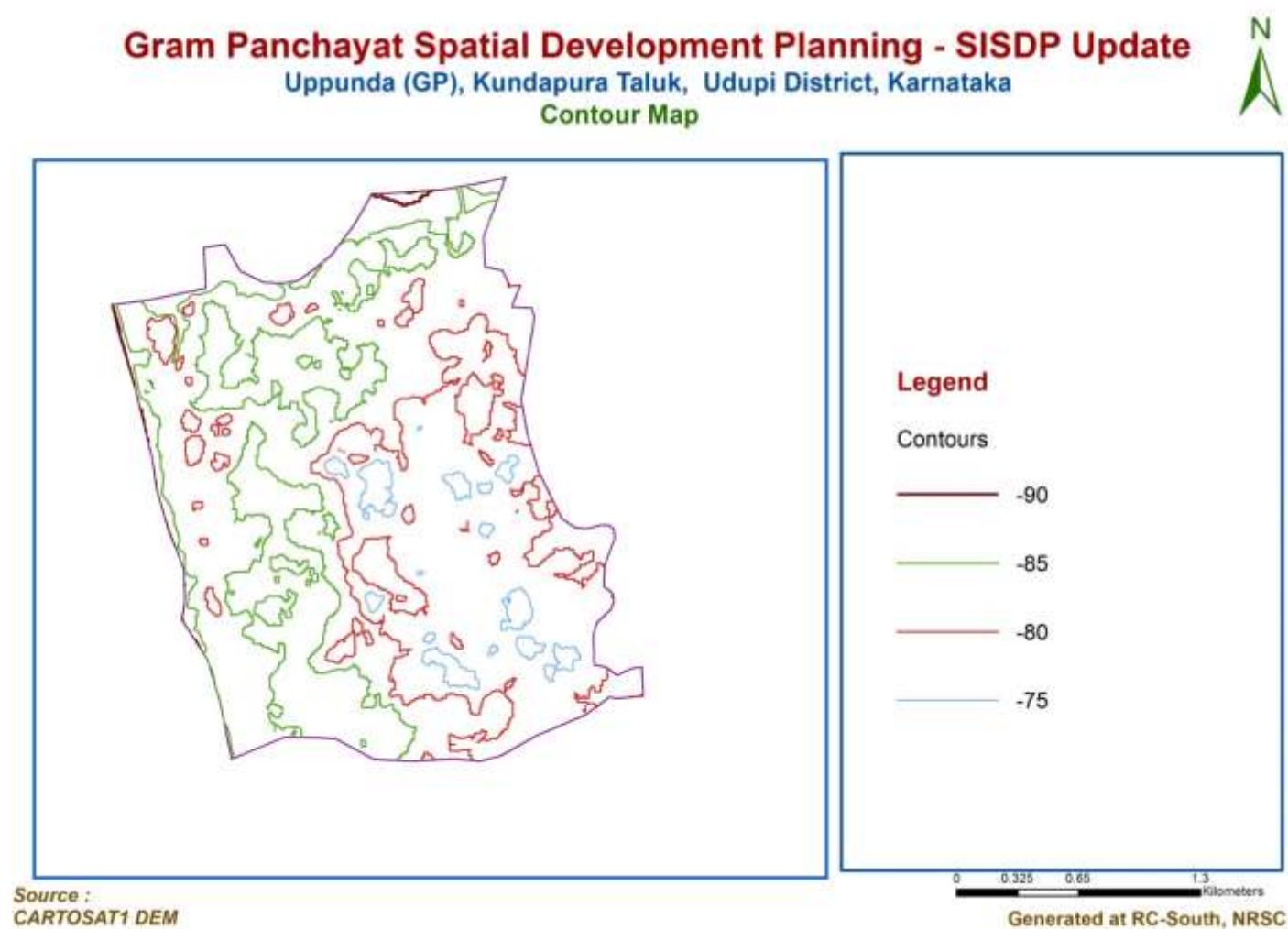


Figure 5-12 Contour map of Uppunda GP

5.6. Derived spatial layers

5.6.1. Proximity analysis

In order to analyze the proximity of Uppunda GP to nearest towns, Kundapura and Bhatkal, distance buffers were overlaid from Uppunda for a distance of 5km, 10 km, 20km and 30 km (Figure 5-12).

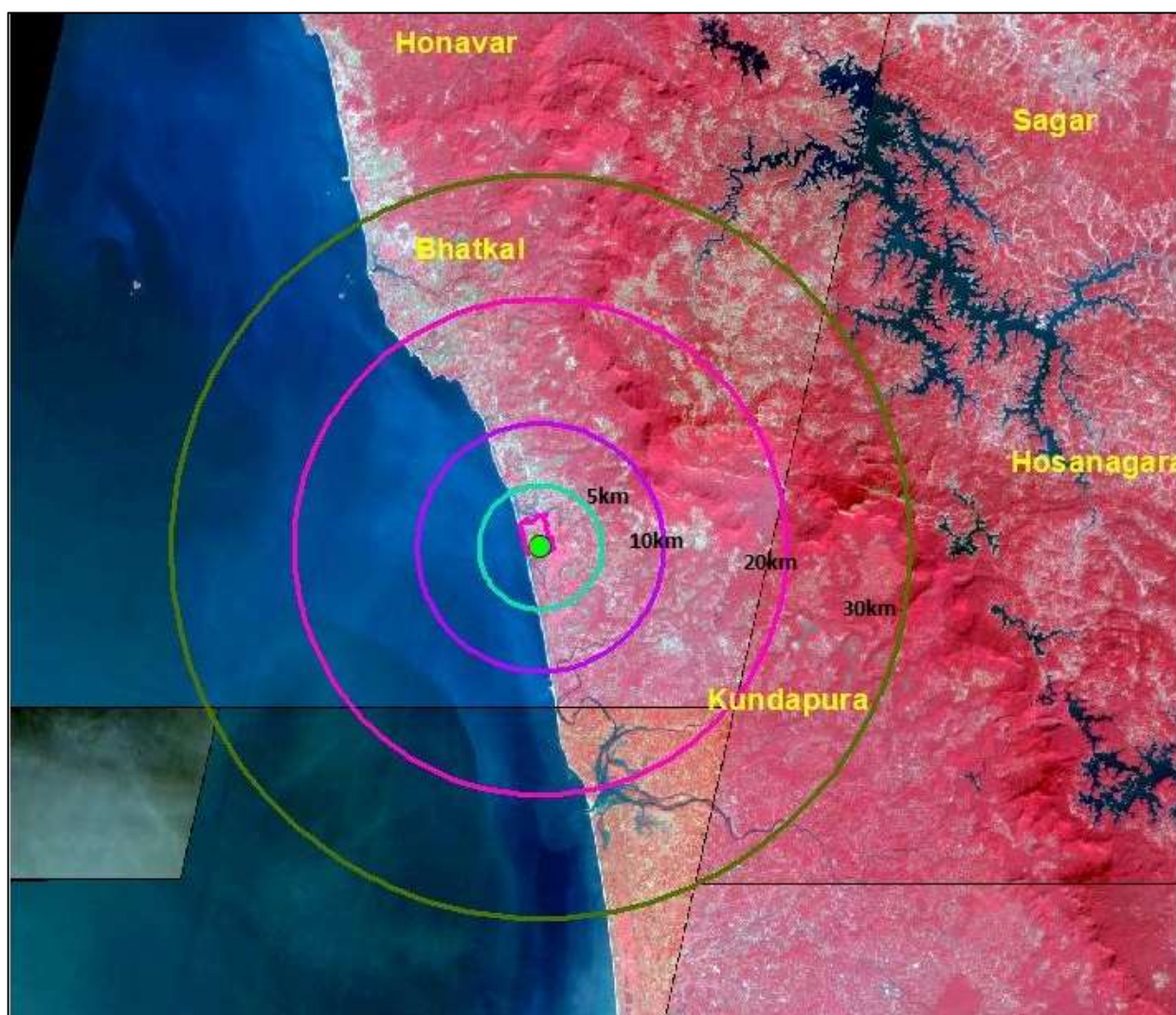


Figure 5-13 Proximity of Uppunda GP to nearest towns Bhatkal and Kundapura



5.6.2. Agriculture Map

Agricultural areas under Gram Panchayat were derived from LU/LC layer at 1:4,000 scale (Figure 5-13) depicting crop land and agricultural plantations.

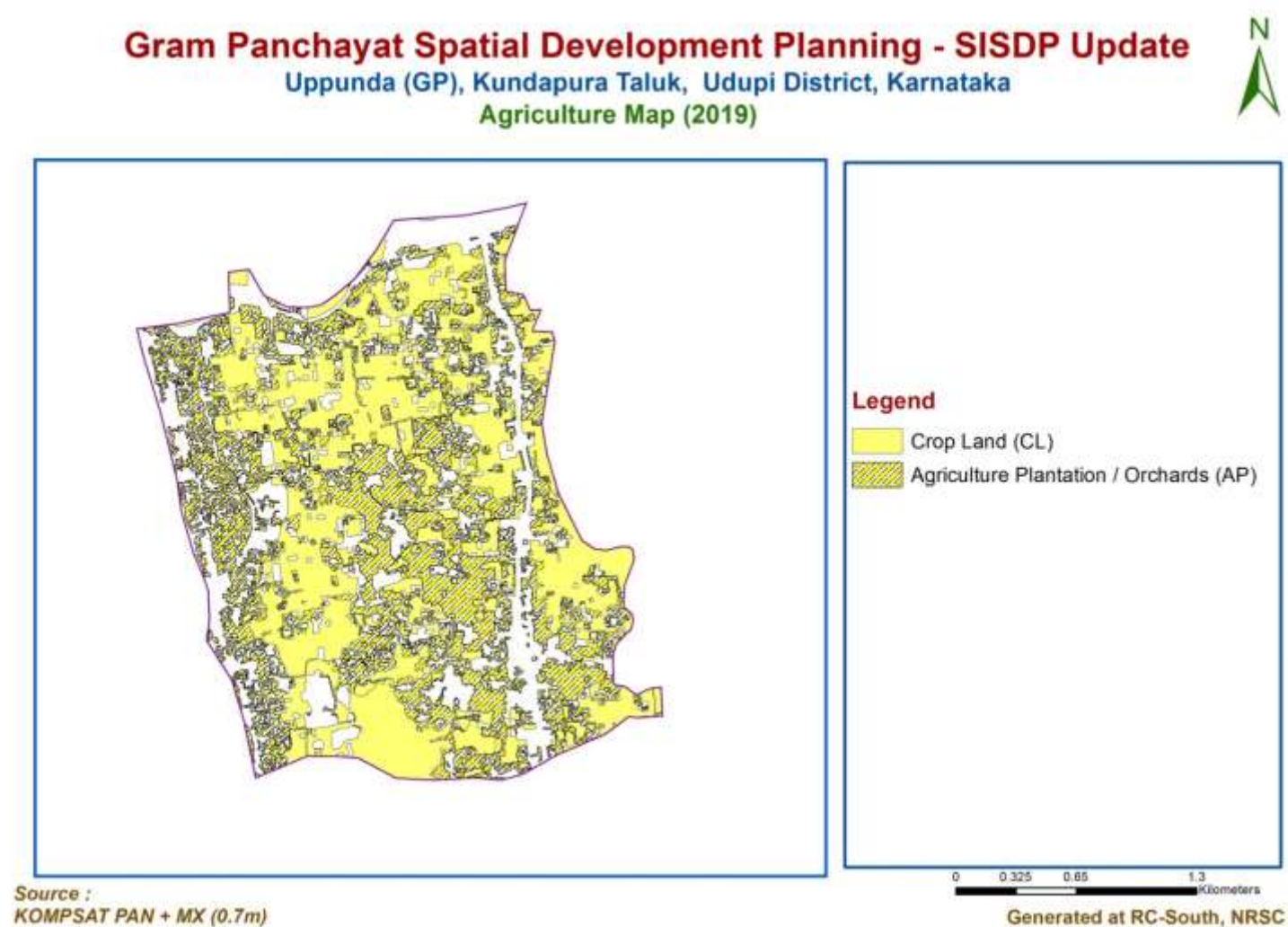


Figure 5-14 Agriculture Map of Uppunda GP

5.6.3. Ground water quality Bore well location map

Ground water quality map shows bore well location (Figure 5-15 and ground water quality parameters are given in Table 5-7.

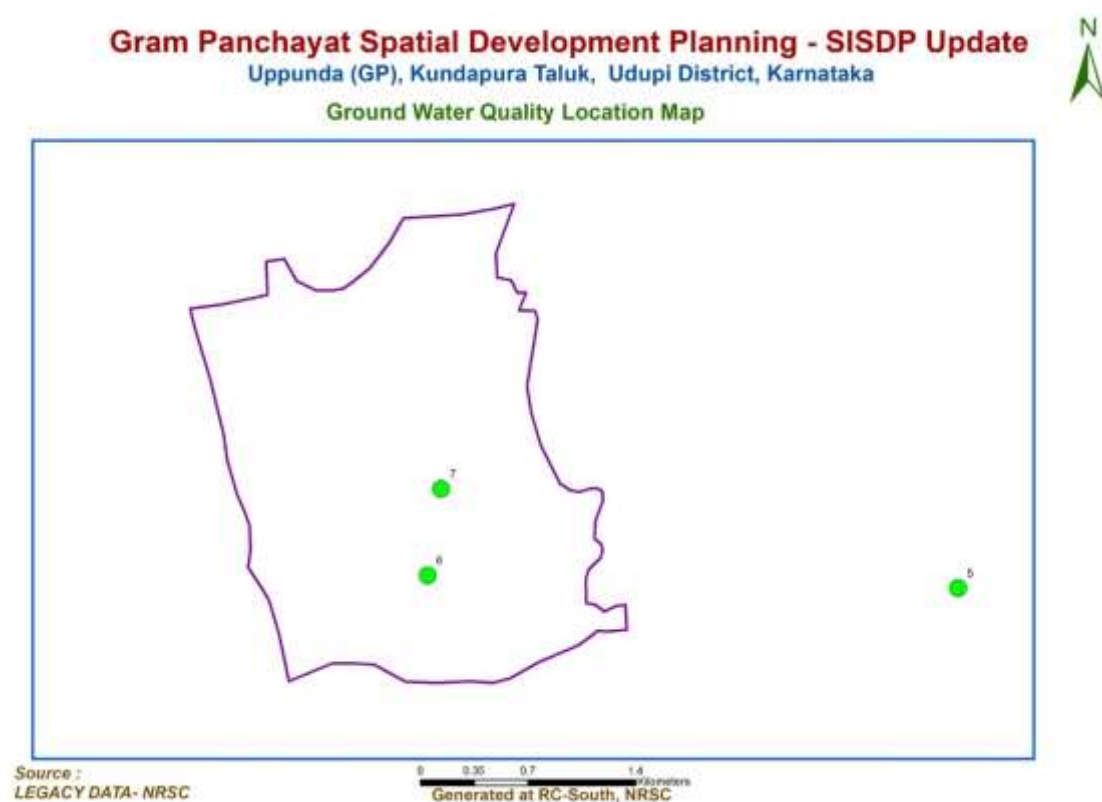


Figure 5-15 Ground water Quality bore well location map of Uppunda GP.

Table 5-7: Ground Water Quality Parameters – Uppunda GP

No.	PH	Hardness	Flouride	GWQ
5	7.0	55	0.2	Potable
6	7.2	95	0.1	potable
7	7.0	75	0.3	Potable

5.6.4. Ground water potential map

Availability of groundwater cannot be assessed directly from remotely sensed data. Hence, its presence must be inferred from manifestation of surface features which act as an indicator of groundwater. Ground water potential map generated under Rajiv Gandhi Drinking Water Mission carried by NRSC was used for planning purpose after updating with high resolution satellite data (Figure 5-14).

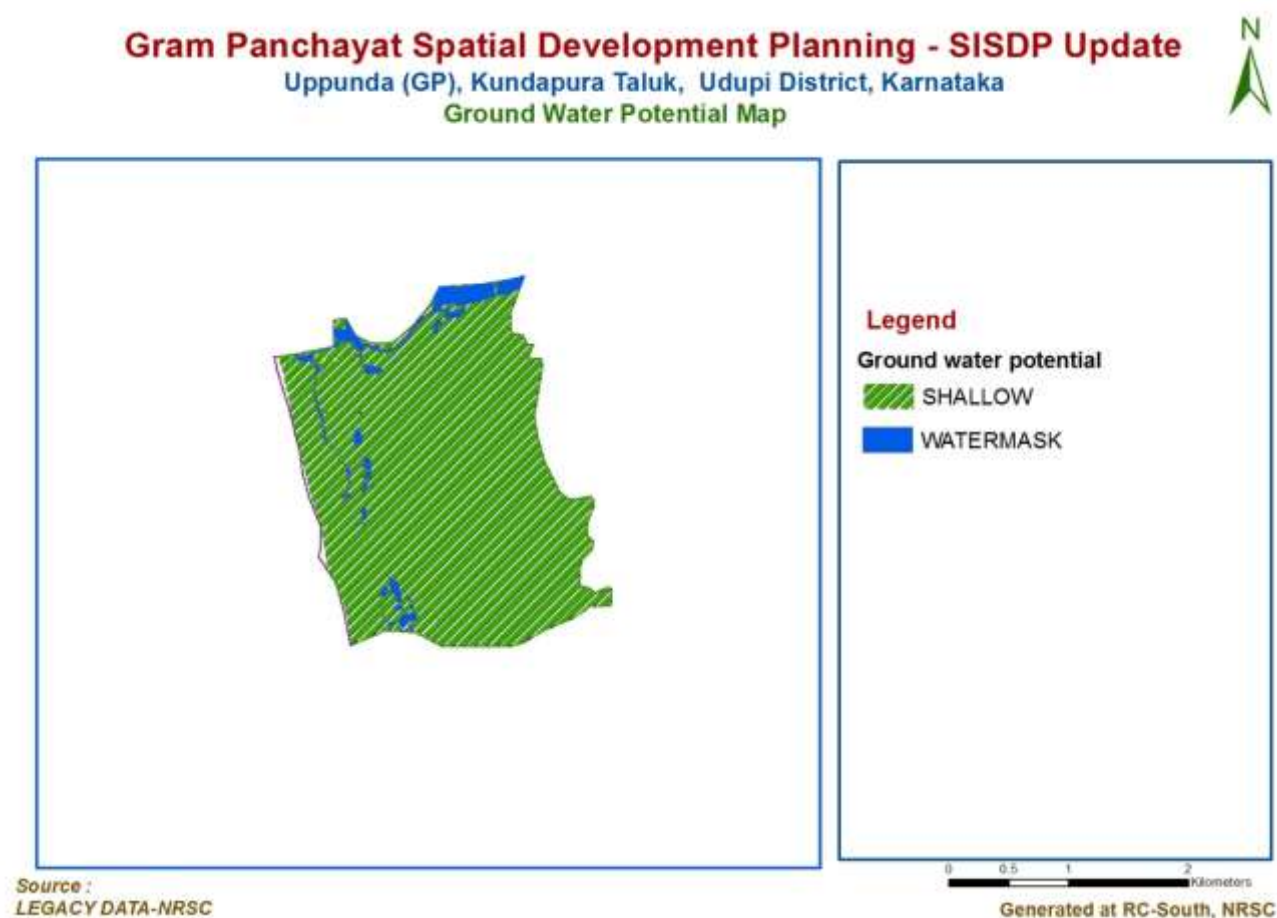


Figure 5-16 Ground water potential Map of Uppunda GP

5.6.5. Rainfall & Runoff estimates

The rainfall data for Shankaranarayana has been obtained from IMD Daily Gridded Rainfall Data Set Over India with grid cell size of (0.25 x 0.25 degree). The annual rainfall of Shankarnarayana varied between 3575mm to 3945 mm during the period 1979-2004 indicating the temporal variability.

Runoff is a general term to indicate the accumulation of excess rainfall, which traverses over surface/sub surface and occurs when rainfall intensity is greater than the rate at which it is able to infiltrate the soil. In this study, one of the most widely used technique USDA Natural Resources Conservation Service (NRCS) Curve Number (CN) method was used for assessment of runoff potential for GP (USDA-SCS, 1985). The spatial distribution of runoff in the study area was computed. Quantitative assessment of runoff serves as basic information for adopting suitable soil and water conservation measures in a watershed/Gram Panchayat. The rainfall and runoff estimates have been given in Table 5-8 From the table it is seen that the runoff coefficient varies between 0.511 to 0.593

Table 5-8 Temporal variability of Rainfall and Runoff estimates for Uppunda GP

year	Rainfall	Runoff	Rainy-day	year	Meteorological Year	runoff coefficient
1979	3574.5	2095.1	126	1979	Dry	0.58612
1987	3966.8	2248.1	149	1987	Normal	0.56673
1995	3915.2	2341	137	1995	Normal	0.59793
1996	3780.1	2130.6	142	1996	Normal	0.56364
2002	3580.5	1831.3	151	2002	Dry	0.51146
2003	3836.9	2277.4	126	2003	Normal	0.59355
2004	3944.5	2170.4	148	2004	Normal	0.55023



5.6.6. Household survey Data Analytics

A few of the important Household survey data analytics are given below.

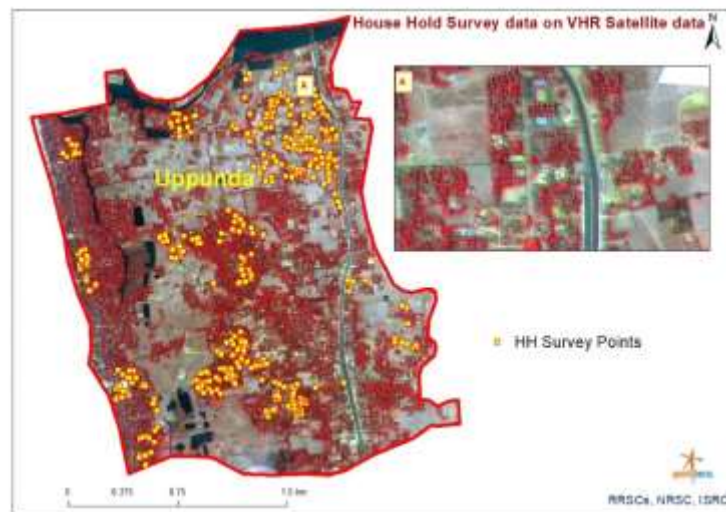


Figure 5-17 Location of household survey

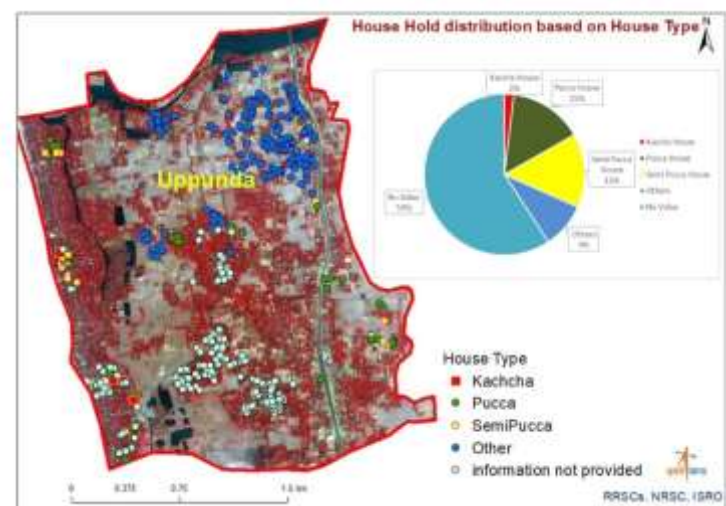


Figure 5-18 Distribution of Household based on house type

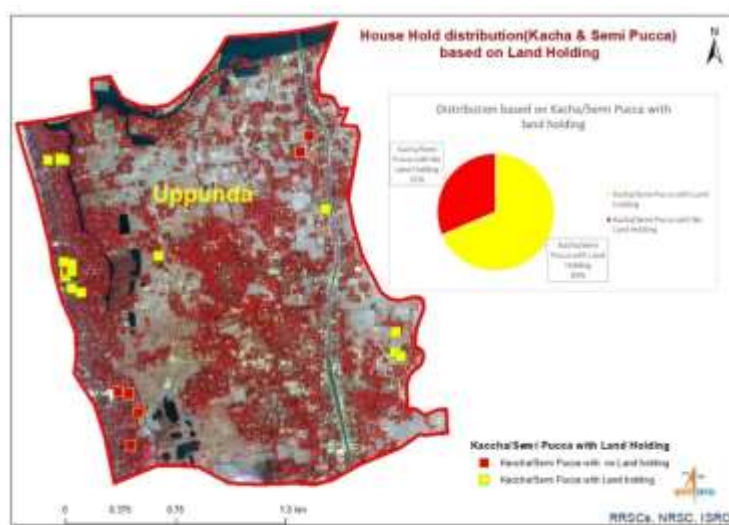


Figure 5-20 Household Distribution (Kuccha and Semi Pucca based on Landholding

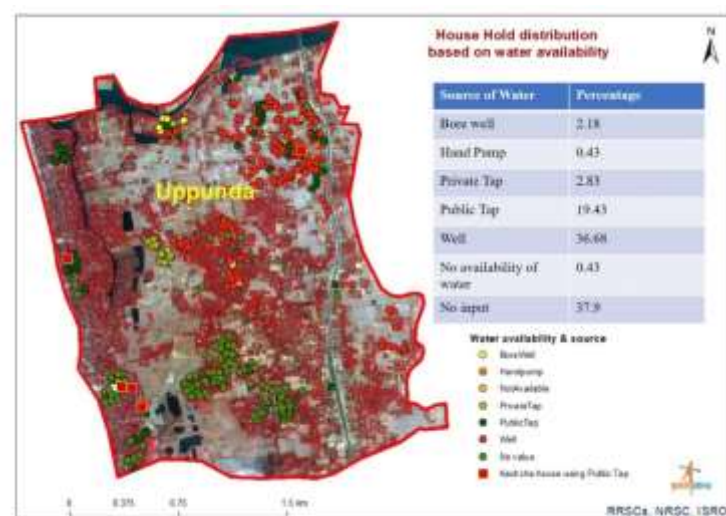


Figure 5-19 Distribution of Household based on water availability

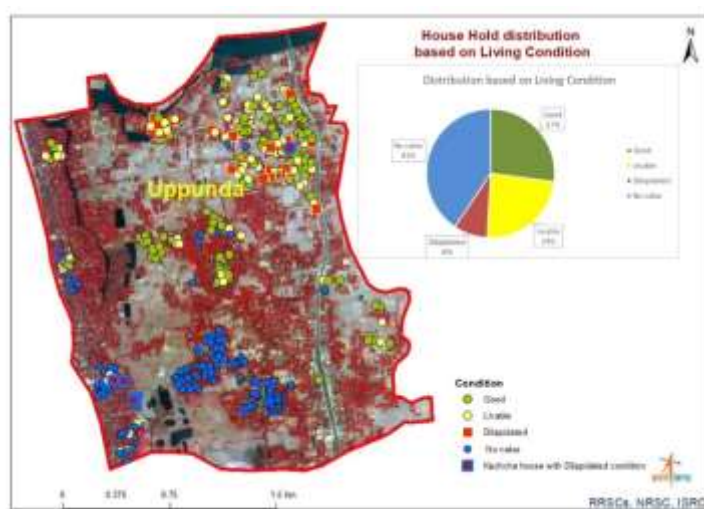


Figure 5-22 Household Distribution based on Living condition

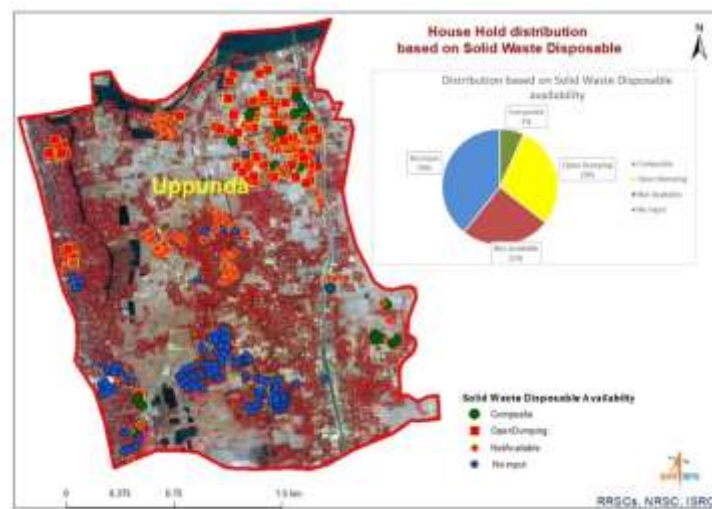


Figure 5-21 Household distribution based on Solid waste management

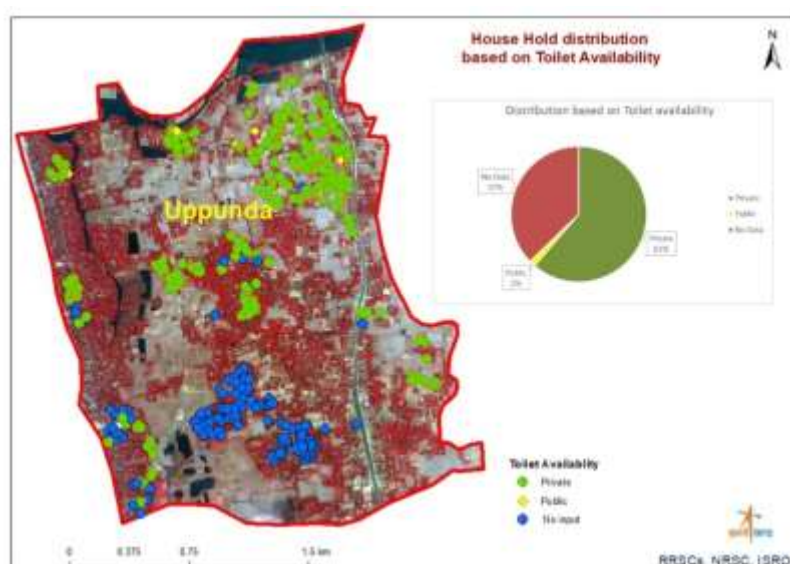


Figure 5-23 Household distribution based on Toilet availability

5.7. Generation of comprehensive development plan for GP

Conservation and sustainable management practices requires the adoption of basic ecological principles in the management of natural resources to ensure the sustainability. To improve the land resources, it is imperative to first improve the water resources of the region. So both the plans should complement each other.

5.7.1. Water Resources Development Plan

At present, Uppunda GP has high rainfall and shortage of water is felt only during the summer months. Due to the proximity of the sea, saline water intrusion is observed and drinking water shortage is felt. In the present study, water resource development plan (WRDP) has been achieved using a decision model that involves the logical combination of thematic maps as well as the ground and field knowledge shared by the Partner institution. The water resource development plan includes identification of suitable zones for taking up locale specific activities in the study area which are generally the areas, where certain type of water resource activity is recommended for implementation. Water conservation measures like percolation tank, farm ponds and recharging bore wells, dug wells etc. fall under location specific activities. The main purpose of these activities is to improve the ground water condition within the GP area which means measures need to be taken to store the water as well as allow water to percolate in to the ground by holding the water in water harvesting structures as much as possible.

In order to identify the suitable zones for location of recharge structures, different thematic layers viz., drainage network with drainage order buffer map, soil, slope and land use/cover and runoff potential were integrated. Subsequently, zones in which the defined conditions of the different thematic layers were fulfilled are identified for location specific activity. The guidelines for the selection of suitable zones for planning location specific activities are adopted from literature (IMSD, 1995). Implementation strategies of some of the recommendations for improving water resources are given in detail. The water resource development is shown in Fig. 5-20

Implementation strategies of some of the recommendations for improving water resources are given in detail

5.7.1.1. Rainwater harvesting

Rainwater harvesting in the settlement area of the GP has two components viz., harvesting the roof water and the other, harvesting the surface runoff. In addition, treated waste water is one important source of water. Currently, most of the drinking water requirement is met through open wells / bore wells and piped water supply.

a) Roof Water Harvesting to meet drinking water requirement of villages

Roof water from the buildings and other paved areas to be collected and stored in sumps for reuse and also for recharging the bore wells after filtering (using pebble, charcoal, sand beds). It would be advantageous to plan this activity while constructing any new building to collect as much roof water as possible and further for diverting this water to the sumps nearby and to the bore wells, after necessary filtering. Designs in this regard need to be worked out separately, taking into consideration of the roof area, rain fall, slope etc. Roof water could be harvested by connecting the pipes and bringing the rainwater to a common pipe and then to sumps (size depends on roof area and requirement) after passing through filter beds. This water can be used for flushing, gardening, washing etc. For the new buildings under construction, harvesting of roof water, through sumps and recharging bore wells could be planned.

b) Groundwater Recharging through rain water harvested:



Some of the common suggestions for ground water recharge and rain water harvesting to be adopted are

- Depth to Water levels during pre and post rainy seasons of all existing bore wells are to be monitored at regular intervals
- All existing bore wells to be directly recharged (after filtering the roof water)
- Existing drain / water ways should be cleaned & maintained and linked
- Direct recharging of bore wells will help in recharging depleted fractures and fissures to have sustainable yield from bore wells

c) Surface Water Harvesting

Surface water may be harvested near bigger settlement and stored in ground level reservoir which can be subsequently pumped to an overhead tank after treatment and supplied.

d) Setting up of STPs

Setting-up of small STPs to recycle waste water which can be used for secondary uses like gardening, industrial cooling, flushing and other secondary purposes. A dual water supply system can be planned within the GP for potable and non-potable water separately, as a viable option to minimize the pressure on fresh water supply.

e) Rejuvenation/ Restoration/ Desilting of Tanks:

The Rejuvenation / Restoration / Desilting of tanks is recommended for all existing tanks which are partially silted up.

f) Drip irrigation

Drip irrigation systems deliver water directly to a plant's roots, reducing the evaporation that happens with spray watering systems. Timers can be used to schedule watering for the cooler parts of the day, further reducing water loss. Properly installed drip irrigation can save up to 80 percent more water than conventional irrigation, and can even contribute to increased crop yields.

g) Farm Ponds / dug out ponds

Capturing and Storing Water in small to medium sized Farm Ponds is another method of storing water. Polythene sheets are generally used to reduce the seepage / infiltration losses. Many farms rely on municipal water or wells (groundwater), while some have built their own ponds to capture and store rainfall for use throughout the year. Properly managed ponds can also help to minimize their impact on the surrounding watershed. This practice may be further encouraged to sustain horticulture, floriculture & vegetable growing.

5.7.2. Land Resources Development Plan (LRDP)

In the present study, LRDP has been achieved using a decision model that involves the logical combination of thematic maps as well as the ground and field knowledge shared by the Partner institution. For arriving at the suitability of a particular land use activity in the study area, thematic maps viz. land use/cover, soil, slope and groundwater potential maps which were generated using remote sensing and GIS were integrated. Expert's knowledge and the field situation was also considered for formulating the alternate land use plans. Methodology adopted from the GIS based land use planning project initiated in India entitled 'Integrated Mission for Sustainable Development', which generates, analyzes and integrates natural resource thematic data in 1:50000 scale, together with satellite remote sensing data has also been a guiding factor in the development plan formulations (IMSD, 1995). The land resource development is shown in Fig. 5-21.



Figure 5-24: Water Resource Development Plan of Uppunda GP



Figure 5-25: Land Resource development Plan of Uppunda GP

5.7.3. Land Resources Development Plan general guidelines

5.7.3.1. Improved Agro-horticulture / Agro-forestry practices (Horticulture Forestry plantations with interspaced cultivation) to bring better returns than the field crops.

5.7.3.2. **Intercropping** in horticulture plantations with vegetables in both seasons may bring better benefits to farmers.

5.7.3.3. Different drought resistant tree-species are recommended for forest nurseries.



5.7.3.4. Soil and water conservation measures: The surface run off could be channelized to recharge the existing and failed bore wells after due filtering. Soil conservation measures such as boulder / vegetative checks in the upper reaches, terracing of the sloppy areas; contour trenches; pits around trees could also be taken up in open areas. Vegetation cover to be improved with planting of trees, plants, etc within the open spaces in the village settlement area

5.7.3.5. Fodder / Tree Plantations: These are suggested in the marginal lands with poor groundwater potential areas and not able to sustain crops. The open forest areas may be converted into grazing lands by over seeding grasses and fuel wood species and these are recommended to meet the demands of local cattle feeding and fuel requirement of local people.

5.7.3.6. Wasteland development: Land with or without scrub (Scrub Lands) come under this category. Over seeding of grasses and agro-forestry plantation are recommended on upland with or without scrub. Water conservation and harvesting structures like loose boulder check dams / Rock dams using available local stones in middle slopes that will help in raising soil moisture. In higher slopes at higher reaches brushwood dams and rubble dams will arrest soil erosion.

5.7.3.7. Crop cultivation based on soil texture: Sandy soil is not good for plants. However, Melon and Coconut can grow in sandy soil. If water is available for irrigation then crops such as pulses Millets can be grown.

5.7.4. Recommendations & Suggestions for improving natural resources in Uppunda GP

- Uppunda being a coastal village has to follow development based on CRZ rules. There is a restriction on construction activity based on different CRZ buffers. Intensification of agro-horticulture/agro forestry with soil/water conservation measures can be taken up based on the CRZ regulations.
- Uppunda is on the National Highway and well connected to the nearest towns Kundapura on the south and Byndoor in the north which are its nearest educational, market centres. Need based development can be planned along the National Highway corridor, based on the future planned activities within the corridor.
- Nearly 36% area of GP is under agriculture category. Mostly single crop paddy is grown in these areas during Kharif, which can be increased to grow vegetables / pulses in the Rabi/Summer utilizing appropriate water resources available through dug wells, farm ponds, percolation ponds. Especially in areas effected by salinity, salt tolerant varieties can be grown.
- Nearly 32% area is under agricultural plantations mostly coconut plantations, which requires adoption of better management practices to improve its yield as well as setting up small scale industries for increasing the livelihood of the locals, especially cashew and coir industries. Here in these areas, farm ponds, recharge pits around the trees, percolation pits have been suggested based on the soil category.
- Fodder crop development has been suggested in the scrub lands to increase the fodder for the livestock. For this Dug out ponds are to be constructed within this area. Existing river and ponds need to be conserved and aquaculture is recommended in the ponds. Roof water harvesting structures have been suggested for the houses within the village settlement / Hamlets & dispersed households. Desalination plant can be setup at the GP level along with aqua purifiers at the ward level within the GP.
- Mixed settlements are commonly found in the coastal GPs with a house in the midst of plantations, both needs to be developed with suitable soil water conservation measures. Three Islands can be developed as tourist spots. The beach already has a rock wall which offers protection against high sea waves. This has to be strengthened with other protection measures like Bio wall. Solar power for street lighting, suitable expansion of roads and improve road connectivity for ease of movement from the coast to the Highway in case of any disaster/emergency management. Setting up of Coir industry, Fish storage places and Market facility are recommended.
- The strategic planning is defined as the future directions for the development of land and water resources in the GP establishing the long-term objectives and mobilizing the financial resources and government policy to achieve hierarchical goals. Further, involvement of local people is quite necessary as part of education, awareness and

consensus. Implementation, monitoring and maintenance of the schemes and evaluation of implemented schemes for their end benefits are also the part of strategic planning activities.

- For successful implementation of land and water resource development plan in the study GP, suitable working scale needs to be identified for data analysis and implementation within the GIS framework. Most of the implementation by the implementing authorities of the government is being carried out with cadastral maps. The large-scale cadastral maps overlaid on the action plan details would be the best format for implementation.

References

- Abdel Rahman A. (2016). *The Use of AHP within GIS in Selecting Potential Sites for Water Harvesting Sites in the Azraq Basin—Jordan*. Journal of Geographic Information System, 2016, 8, 73-88, <http://www.scirp.org/journal/igis>, <http://dx.doi.org/10.4236/igis.2016.81008>
- Ahmad I., Verma M. K., 2016. *Site Suitability Mapping for Water Storage Structures using Remote Sensing & GIS for Sheonath Basin in Chhattisgarh State*. International Journal of Applied Engineering Research, 11(6): 4155-4160
- Bamne Y., Patil K. A., Vikhe S. D., 2014. *Selection of Appropriate Sites for Structures of Water Harvesting In a Watershed Using Remote Sensing and GIS*. International Journal of Emerging Technology and Advance Engineering, 4(11): 270-275
- Birthe Riisnes Erle Kristvik. (2015). *Hydrological Assessment of Water Resources in Bergen*. Master of Science in Civil and Environmental Engineering Submission date: 10 June 2015.
- Central Ground Water Board (2007). *Manual on Artificial Recharge of Ground Water*. Ministry of Water Resources, Government of India, New Delhi.
- García, A., Sainz, A., Revilla, J.A., Álvarez, C., Juanes, J.A., Puente, A., 2008. *Surface water resources assessment in scarcely gauged basins in the north of Spain*. J. Hydrol. 356, 312–326. doi:10.1016/j.jhydrol.2008.04.019
- Government of India Ministry of Water Resources. *Guidelines for Repair, Renovation and Restoration of Water Bodies with External Assistance*. (2009).
- ISRO Guest House Report. (2019). *Augmentation of water supply at ISRO Guest House, Devanahalli, Bengaluru, Karnataka Using Geo-spatial Techniques*. Indian Space Research Organisation (ISRO) Hqrs. Department of Space, Bengaluru.
- I. Ahmad and M.K. Verma. (2017) *GIS based analytic hierarchy process in determination of suitable site for water storage*. European Water 60: 139-146, 2017. © 2017 E.W. Publications.
- IMSD, 1995. *Integrated Mission for Sustainable Development: Technical Guidelines*. NRSA, Hyderabad, India, 1-27. LULC, Bhuvan (ISRO) - bhuvan.nrsc.gov.in/gis/thematic/index.php
- IPRC Campus Report. 2018. *Water Resources Development and Management Plans for ISRO Propulsion Complex (IPRC) Campus, Mahendragiri, Tirunelveli District, Tamil Nadu*. RRSC–South, NRSC, ISRO. Bengaluru. NRSC-RC-REGBANG-RRSC-BANG-APRIL-2018-TR-1138-1.0
- ISITE Campus Report. 2017. *Water Resources Development and Management Plan for the ISRO Satellite Integration and Test Establishment (ISITE) Campus*. RRSC–South, NRSC, ISRO. Bengaluru.
- James Batchelor. (April 2013). *Using GIS and SWAT analysis to assess water scarcity and WASH services levels in rural Andhra Pradesh*.
- Kumar, P., Tiwari, K.N. and Pal, D.K. (1997). *Establishing SCS runoff curve number from IRS digital database*, Journal of Indian Society of Remote Sensing, 19(4): 246–251.



Manual for Local Level Assessment of Land Degradation, Sustainable Land Management and Livelihoods Part 2. *Water resources assessment*. Field methodology and tools. Land Degradation Assessment in Drylands (Lada) Project.

MCF Campus Report. 2018. Water Resources Development and Management Plans for Master Control Facility (MCF), Hassan district, Karnataka. RRSC–South, NRSC, ISRO. Bengaluru. NRSC-RC-REGBANG-JAN-2018-TR-1110-1.0.

Murthy, V.V.N. (2003). *Land and Water Management Engineering*. Kalyani Publishers, New Delhi.

Narsimha Kota¹, Nallaganthula Ramudu, S. Ravikumar, M.Suresh. *Hydrogeomorphological Mapping Upto Cadastral Level, By Using High Resolution Satellite Data In Gokaphaslwada Watershed, Doulthabad Mandal, Mahabubnagar District*. IOSR Journal of Applied Geology and Geophysics (IOSR-JAGG) e-ISSN: 2321–0990, p-ISSN: 2321–0982. Volume 5, Issue 1 Ver. II (Jan. - Feb. 2017), PP 46-51 www.iosrjournals.org

Nyatuame M, Owusu-Gyimah V and Ampia F (2014) *Statistical Analysis of Rainfall Trend for Volta Region in Ghana*. Int. J. Atmos. Sci. 67(2) 1-11.

Rajendran V, Venkatasubramani R and Vijayakumar G (2016) *Rainfall variation and frequency analysis study in Dharmapuri district (India)*. Indian J. Geo. Mar. Sci. 45(11) 1560-5.

Padmavathy A. S., Ganesha Raj. K., Yogarajan N., Thangavel P., 1993. *Check Dam Site Selection Using GIS Approach*. Advance Space Research, 13(11): 123-127

Rao, K.V., Bhattacharya, A.K. and Mishra, K. (1996). *Runoff estimation by curve number method- case studies*, Journal of Soil and Water Conservation, 40: 1–7.

Ramesh, K.S., S. Rama Subramoniam and K. Ganesharaj. 2019. Water Resources Assessment and Generation of Comprehensive Water Resources Development and Management Plans for Indlawadi Gram-Panchayat, Anekal Taluk Using Geospatial Technology. A technical Report. Published at RRSC-South, NRSC, Bengaluru.

Ranjit Kumar Sahu. (May 2015) *Hydrological Analysis for Urban Water Management*.

Sethupathi A.S, Lakshmi Narasimhan C, Vasanthamohan. (2012) *Evaluation of hydrogeomorphological landforms and lineaments using GIS and Remote Sensing techniques in Bargur – Mathur subwatersheds, Ponnaiyar River basin, India*. International Journal of Geomatics and Geosciences, Volume 3, No 1, 2012. ISSN 0976 – 4380.

Saraf A.K. et al., (1996). *Integrated use of remote sensing and GIS methods for Groundwater exploration in Hydrology and water resources*, New Delhi, 251-259.

Shivakumar BL, *Artificial recharge of groundwater using rooftop rain water harvesting*. RV College of Engineering, Department of Civil Engineering, Mysore Road, Bengaluru.

Sharma, S.K., Kansal, M.L., Tyagi, A., 2015. *Resource assessment and strategic planning for improvement of water supply to Shimla city in India using geo-spatial techniques*. Egypt. J. Remote Sens. Space Sci. 18, 85–97. doi:10.1016/j.ejrs.2015.04.001

Spatial data for GPSDP. 2020. Standards of Spatial data Provided for Gram Panchayat Spatial Development Planning. NRSC, Hyderabad. Document No.: NRSC-RC-RCDELHI-SEPT-2020-TR-1656-V1.0.

Tera Marahi Moses. (July 2012) *Assessment of Water Resources Utilization and Management in Chahi Sub-Catchment, Kisoro District, Uganda*.









6. History and Heritage- Loka

6.1. History of South Canara







Karnataka's brief history has presented here very briefly. The history of south Canara talks about the different empires and rulers ruled on south Canara's land throughout time. This time-line show traced back to the 3rd century, and it also talks about the current administrative bodies in the region. Traditionally, it is believed that parts of Karnataka are subjected to the Nandas and the Mauryas. Maurya Chandragupta is believed to have visited Shravanabelgola and spent his last years there. Satavahanas rule started from 250 BC and went up till 230 AD. The Gangas and the Kadambas ruling from c.345 AD; the Chalukyas of Badami in Bagalkot district (c.540 to 753 AD) overthrowing the Kadambas and subjugating the Gangas; the Alupas ruling in the coastal region as minor rulers for more than 1000 years; the Rashtrakutas of Malkhed from Gulbarga district (753 to 973 AD) succeeding the Badami Chalukyas, and they, in turn, were overthrown by the Chalukyas of Kalyana (973 to 1189A.D), ruling from modern BasavaKalyana, in Bidar district. The Gangas who continued in the Southern parts, earlier as sovereign rulers (350 to 550 A. D) and later as allies or feudatories of either Badami or Malkhed rulers till 1004 AD, paved the way for the Chola rule when their territory viz., Gangawadi-96,000 (Southern Karnataka) was occupied by the Cholas. The Cholas, who dominated over Southern Karnataka from about 1004 AD, were overthrown by HoysalaVishnuvardhana in circa 1114 AD. During the KalyanaChalukya rule came the Kalachuri Interregnum (1162-1184). It witnessed Basava and his Veerashaiva movement. The KalyanaChalukyas were overshadowed by their feudatories, viz., the Sevunas of Devagiri and the Hoysalas of Dwarasamudra, who divided Karnataka between themselves; when the armies of the Delhi Sultanate overthrew these two dynasties, the Vijayanagara Empire (1336) and the Bahamani Sultanate (1347) came to rule over Karnataka. The former had control over the greater part of Karnataka. Of the five Shahi Sultanates, which succeeded the Bahamanis, Bijapur's dilshahis (1489-1686) and the Baridshahis of Bidar (1504-1619), who held sway over northern parts of Karnataka and at a later stage, the former dynasty overthrew the latter. The city of Vijayanagara was sacked by the combined Shahi forces of Deccan in 1565. They fled away Vijayanagara commander Venkatapatiraya and Tirumalaraya decided to shift the empire's capital first to Penugonda (1565), and later, to Chandragiri both in Andhra Pradesh and subsequently to Vellore (Tamilnadu), beyond the frontiers of Karnataka. It continued as capital till 1646. Of Vijayanagar's successors in Karnataka, among their numerous feudatories, the Mysore Odeyars, ChitradurgaPalegars, MagadiPalegars, and the Keladi Nayakas were the most important. The northern regions were under the control of the Adilshahis of Bijapur till 1686, when they were overthrown by the Mughals. With the weakening of the Mughal power in the north, the Marathas came to control Karnataka's northern districts. Haidar Ali, who usurped power from the Odeyars of Mysore in 1761, captured both Keladi and Chitradurga Kingdoms in 1763 and 1779 extended his sway over Mangalore. Later, Karnataka came under British rule immediately after Tipu's overthrow, Haidar's son, in 1799 and the Marathas in 1818, when the Peshwa was defeated by the British. But after having been subjected to several administrations during the British rule and witnessed active participation in the freedom struggle for Self rule, it became a single State in 1956, and in 1973 it was renamed 'Karnataka.' (Source: Dreiser, T. (2015). Chapter li. Sister Carrie. [tps://doi.org/10.9783/9780812291575.12](https://doi.org/10.9783/9780812291575.12))






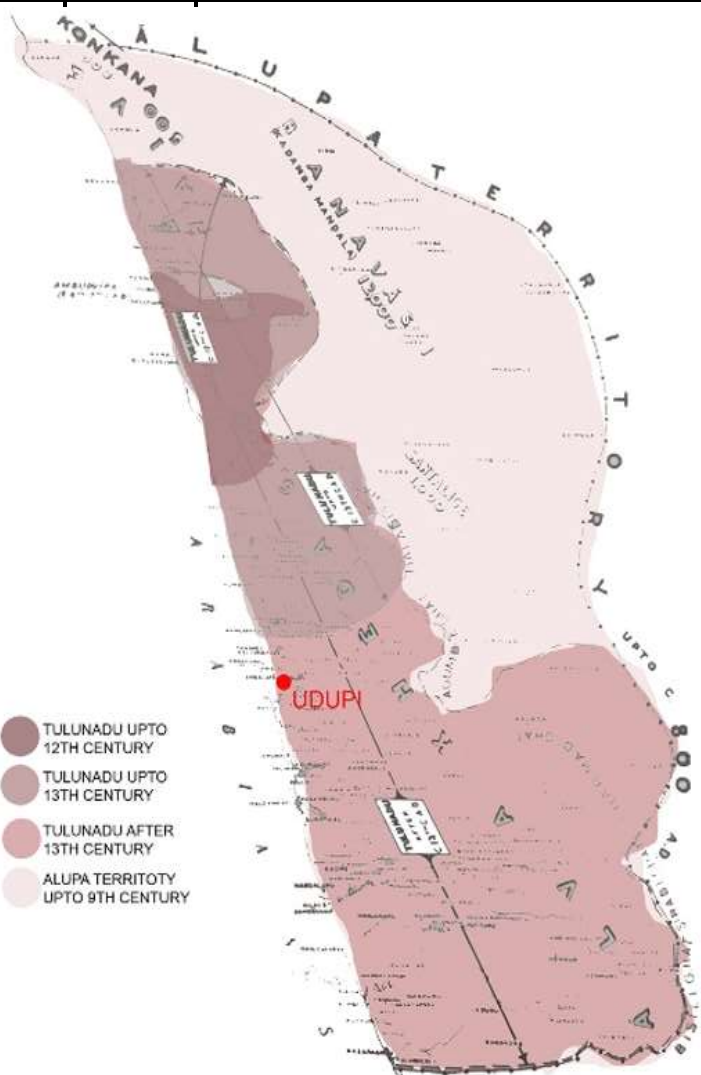

6.2. Historical timeline of rulers in South Canara

South Kanara was annexed by the British East India Company following the defeat of Tipu Sultan in the Fourth Mysore War 1799 and along with North Kanara formed the district of Kanara in the Madras Presidency. In 1859, Kanara was split into two districts, North and South. North Kanara was transferred to the Bombay Presidency, and South was retained by Madras. Mangalore was the administrative headquarters of the district. The district covered an area of 10,410 square kilometres (4,021 sq mi).


Sr. No.	Ruling Period	Map	Sr. No.	Ruling Period	Map
1	Starting Period around 3 BCE	 <p>Figure 6-1 Shatavahana Empire</p>	5	CE. 757 – 973	 <p>Figure 6-2 Ratrakutha of Malakeada</p>
2	CE. 325 - 540	 <p>Figure 6-3 BanavasiKadamba</p>	6	CE. 973 – 1198	 <p>Figure 6-4 Chalukyays of Kalyana</p>
3	CE. 325 – 999	 <p>Figure 6-5 Gangas of Talakad</p>	7	CE. 1198 – 1312	 <p>Figure 6-6 Sevunas of Devagiri</p>



4	CE. 500 – 757	 <p>Figure 6-7 Chalukyas of Badami</p>	8	CE. 1000 – 1346	 <p>Figure 6-8 Hoysalas of Dwarasamudra</p>
9	CE. 1336 – 1565	 <p>Figure 6-9 Vijayanagara</p>	13	CE. 1399 – 1761	 <p>Figure 6-10 Odeyars of Mysore</p>
10	CE. 1347 – 1527	 <p>Figure 6-11 Bahmani</p>	14	CE. 1588 – 1779	 <p>Figure 6-12 Nayakas of Chitradurga</p>

11	CE. 1490 – 1686	 <p>Figure 6-13 Sultans of Bijapur</p>	15	CE. 1761 - 1799	 <p>Figure 6-14 Sultanate of Srirangapatana</p>
12	CE. 1500 – 1763	 <p>Figure 6-15 Nayakas of Kelaedi</p>	16	CE. 1800 – 1831	 <p>Figure 6-16 Mysore Odeyars</p>
17	CE. 1831 - 1881	 <p>Figure 6-17 British Takeover</p>	 <p> TULUNADU UPTO 12TH CENTURY TULUNADU UPTO 13TH CENTURY TULUNADU AFTER 13TH CENTURY ALUPA TERRITOTY UPTO 9TH CENTURY </p>		
18	CE. 1881 – 1950	 <p>Figure 6-18 Mysore Wodeyars</p>			



19	CE. 1956 – Present	 <p>Figure 6-19 Karnataka Govt</p>
----	--------------------------	--

(Source: Dreiser, T. (2015). Chapter li. Sister Carrie.
[tps://doi.org/10.9783/9780812291575.12](https://doi.org/10.9783/9780812291575.12))

Figure 6-20 Evolution of Tulunadu_: Udupi study report

6.3. Udupi District at a Glance

Udupi is one of the twenty-seven districts in the state of Karnataka. It was formed on August 24, 1997, carved out of the erstwhile Dakshina Kannada (South Kanara) community with three taluks, namely Udupi, Karkala, and Kundapura.

Udupi city is the District Head Quarters. Administratively, the district has 248 villages, 146 GPs, one city municipality (Udupi city), two town municipalities (Karkala and Kundapura), and one town panchayat (Saligrama). Sheltered by the

soaring Western Ghats on the east and bordered by the Arabian Sea's blue waters, the Udupi district is blessed with abundant rainfall, fertile soil, and lush vegetation. The community is well known for Yakshagana- a fabulous costumed dance-drama form, Kambala- the sport of buffalo racing by farmers, Kori-Katta (Cock Fight), and Bootha Kola. The district is a hub for Cashew processing Industries and outsourcing companies. Historically, the culture of other regions influenced and fused with the local culture and evolved into a distinctly different culture from other cultures known as Tuluva culture. Tuluva culture got a lot of importance at the Vijayanagar Empire's time in the early 14th century. The Udupi district, along with Dakshina Kannada, was, after that, commonly known as "Tulunadu." Tulu was the spoken language of the people. Tuluva culture is known for nature worship, particularly Naga-Aradhana-snake worship and Boota-Aradhana- spirit worship. The district is also known for the birth of the Advaitaphilosophy of Shankaracharya in the ninth century and the Dvaitaphilosophy of Madhwacharya in the thirteenth century. The community now has more than 50 important temples, 12 churches, 10 mosques, and a Jain religious basis.



Figure 6-21 Udupi District Tourism Map Source: District Government Website



6.4. Uppunda Gram Panchayat at a Glance

Uppunda is a village in Byndoor Taluk with west coast of the village on the Arabian sea in South India. The nearest city with an airport is Mangalore which is about 119 kilo-meters away. The town is reachable by water and road from Mangalore. Nearest railway station Byndoor Mookambika Road(BYNR) railway station. It is located in the Byndoor taluk of Udupi district in Karnataka.

Before 1951 Uppunda was a part of the larger Madras state within the British East India Company empire and was annexed Karnataka in free republic India. Majority of people in town speak Kundagannada dialect of Kannada language and Konkani.

Uppunda is also home to one of the largest temple Durgaparameshwari Temple. Every year thousands of people gather to celebrate "KODI HABBA" during the winter months of November and December, which involves transporting the main village deity on a huge chariot, also known as Rath-Utsav or Ratha-Yatra in some parts of India. There are also a



dozen other temples within the village such as Raghavendra Swami Mata, Venkataramana Temple, Mood Ganapathi Temple, Shiva Temple.

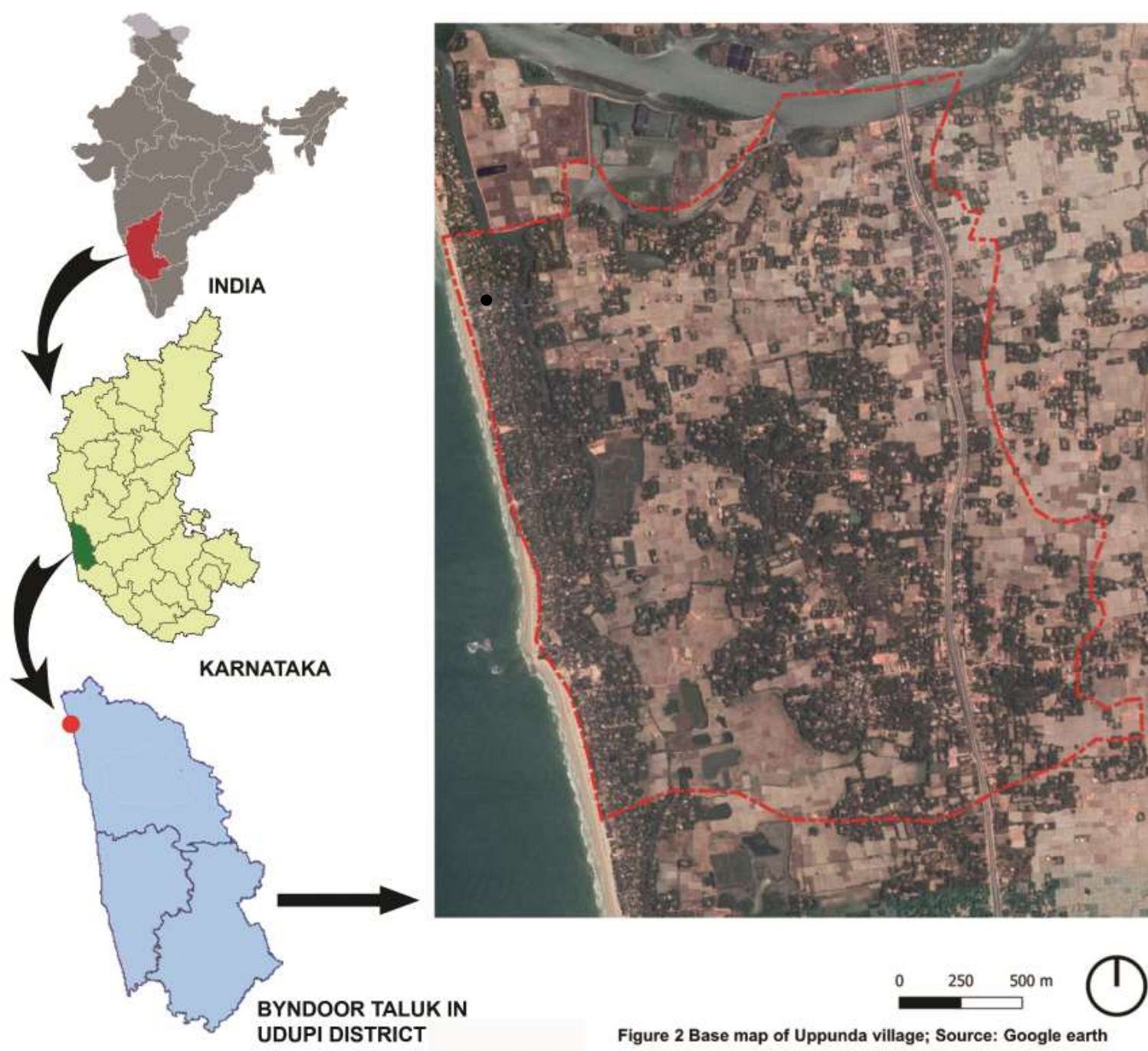


Figure 6-22 : Location map of Uppunda

6.5. History of Uppunda

In Ramayana saindhava king had ruled and the place was called Lavanapuri/ Saindavapuri. This land was also known as Parshurama Kshetra. Ravana carried the Atma Linga and crossed this place along the west side of the sea, 'Gokarna' is the proof of this story. It is believed in 2nd and 3rd century king Ashoka had visited this place to preach about the religion of Buddhism nearby Banavasi along this route via south side of Ankola, he sent his son and daughter to Sri Lanka. Merchants from Rome and Mesopotamia visited this place for trade. During Hizari century, Muslims also came and built mosque and offered prayers. In 3rd and 4th century, Banavasi near Sirsi was made as centre by Kadambas. The king Mayur Varman donated the places like Gokarna, Kodavar, Saligrama and Udupi to Brahmins to perform yadnya's, prayers etc. all these details can be read on inscriptions. Kollur Mookambika and Uppunda Durga Parmeshwari are said to be sisters and all the rituals belonging to them are almost same. The idol of goddess is made up of a normal big stone along with two circular ball like stones. Just below the goddess, Sri Chakra and Ashtabandh can be seen. The two round circular stones are named as Mahakali, Mahalaxmi and Maha Saraswati. The Shivalinga has originated by itself. 'Srichakra' has great importance and strength. Lord Ganesh is seen on pillar, Tulasi katte, Olaga Mantapa, Lord Veerabhadra, Ishwar temple tirtha mantap, chariot can be seen. Till the reign of Tipu Sultan local kings, local leaders used to rule and collect the revenue and look after the law and order of that place. The fixed assets, funds are looked after committee members and government revenue officers. After independence, Madras government used to look after this. In the year of 1992 the committee members prepared the masterplan and taken the permission

from the concerned department and renovated the main sanctum which was leaking. The roof has been made of copper metal and work was completed.

6.6. History of of Shri Durga Parameshwari temple:

The village is situated between Kundapura and Bhatkal on the main highway NH17 (East Side), Sumana river at North side. Usually the rivers that flow in the North direction are said to be holy and powerful. Many famous temples are situated on the banks of such rivers. On the left side of Sumana river, facing eastwards is the temple of Durga Parmeshwari situated, Here Agasthya tirtha, Matanga tirtha, Sumana river, Devi Lake and sea can be viewed. Tuesday and Friday are the auspicious days of the temple. All these information are found through ancient time Skanda Purana and Ramayana.

Temple is in the form of Chalukyan Style (8th century) built with stone and engraved with sculptures. This is one of the oldest temple is being looked after local people. In this temple, there are 3 stone inscriptions and 10 copper inscriptions. The prayers sung early in the morning, in praise of goddess, and importance of Sumanavati river are very famous. The people who know about this are proud to be a part of this place and religious culture still many records have to be found out regarding Uppunda and Bijoor villages. Because of this temple, the culture and economy of the people have improved and maintained till today and also progressed. Religious Puja takes place everyday such as Aarati, Ashthastotra, Sashasranamam, kumkuma archana, tulabhar, panchamruta, chandika hom, satyanarayana puja and distributing Prasad. Special pujas take place on certain auspicious days and festivals every year fair is taken place and nearby people from villages attend and perform puja. There is a working committee to look after the renovation and development of the temple. There is well maintained infrastructure which includes garden, drinking water facility, toilets and library.



Figure 6-23 Shri Durga Parameshwari temple, Uppunda
Source: GP Survey Group, MSAP

6.7. Timeline of rulers:

1.Stone inscription language Kannada, Uppunda

Name / Stone Inscription No.	Dynasty /Ruler	Year
Uppunda 1	Aloop-Pandya Soyeedav	1322 May 31 st
Uppunda 2	Aloop-Pandya Soyeedav	14 th Century
Uppunda 3	Vijayanagara Immudi Devaraya	1446 May 1 st
Uppunda 4	Vijayanagara Mallikarjuna	1451 October 31 st
Uppunda 5	Katarasa	1377 February 8 th
Uppunda 6	Parasu Hegde	1482 October 17 th

2. Copper Inscription

Name/ Copper Inscription No.	Dynasty/ Ruler	Year
Uppunda 6	Vijayanagar Immudi Devaraya	1444 Feb 4 th
Uppunda 7	Not Available	1515 September 28 th
Uppunda 8	Not Available	1515 December 30 th
Uppunda 9	Krishnaraya (Vijayanagara)	1528 November 21 st
Uppunda 10	Vijayanagara Achyutraya	1540 October 10 th
Uppunda 11	Haduvalli Devara Vodeya	1539 February 23 rd
Uppunda 12	Haduvalli Channabhaira Devi Amma	1556 June 17 th
Uppunda 13	Haduvalli Channabhaira Devi	1556 July 31 st



Uppunda 14	Haduvalli Channabhaira Devi	1556 September 14 th
Uppunda 15	Haduvalli Channabhaira Devi	1556 June 14 th
Uppunda 16	Haduvalli Channabhaira Devi	1563 April 15 th
Uppunda 17	Haduvalli Channabhaira Devi	1562 Jan 21 st

3. Veragallu (stone)

Name/ Stone Inscription No.	Dynasty/Ruler	Year
Bijoor 1	Pombucchada	1025 May/June
Bijoor 2	Senavadiraj	11 th /12 th Century
Bijoor 3	Hoysala Queen Chikkaitai	1335 December 10 th

6.8. The Nature worship:

Fishermen (Mogaveeras) in the beginning lived near water resources, such as, lakes, rivers which were surrounded by large variety of vegetation. The fact to be noted is that fishing, particularly, in the sea and in the rivers, instilled fear of the unknown in the hearts of these fishing communities. This fear of unknown had driven these people to worship everything which they could not comprehend. It explains why large numbers of trees (Aswatha), tombs (representing dead person), animals (bull), serpents, rivers, sea etc. were worshipped. In other words, means living and life sustaining sources which were beyond their comprehension became the objects of worship.



of

Figure 6-24 Tulsi Katte at entrance of houses in Uppunda

Source: GP Survey Group, MSAP

6.8.1. Worship of Sea:

Mogaveeras consider sea as their God (Ganga Maatha) and hold in awe for its vastness and at times its ferocity. One of the most prominent nature worships is that of the sea after the monsoon by all the members of the community by offering milk and coconut with prayer to allow them to venture into sea for fishing. It is also believed that cremation near seashore and letting the ash (last remains of dead) into sea is the most sacred way of performing last rites. This is practiced by all the communities residing in coastal villages including Mogaveeras.

6.8.2. Worship of Tulsi and Tree:

Watering Tulsi plants in the morning and performing Surya Namaskara is the daily routine followed even today. Ancient system of Panawoo Kattunu, depositing money in a box, for various temples including Thirupathi is done in front of Tulsi Katte . Panaka Pooje used to be held in front of Tulsi Katte . Worshipping Sun God (Surya Namaskara) is also done in front of the Tulsi Katte which is a normal practice in Mogaveera house hold. Lighting a mud lamp (Thibile) and singing Bhajans before Tulsi Katte is being practiced even now. Every Bhajana Mandira has its Tulsi-Katte . Tulsi Katte is erected before the Daivasthana and in many a case, Daiva Darshan is also held before the Tulsi Katte . In Moolasthanans , Tulsi, Ashwatha tree, Sampige tree , Ranjeda tree (a fruit bearing tree) etc. are present. In a way, coconut tree is also



Figure 6-25 Tulsi Katte at entrance of houses in Uppunda

Source: GP Survey Group, MSAP

worshipped as Kalpavraksha which fulfills many needs of our people. A tree known as Kaverida Mara (its leaves and fruits are bitter) is the sacred tree planted in front of Shree Mahasathishwari Mahastri Amma Temple, Kodi Kanyana. Tulsi katte is a platform or pedestal for basil tree in front of houses. The system of worshipping tulsi katte is seen in almost all houses in uppunda. Lighting mud lamp, watering tulsi plant in morning along with sun worshipping is practiced by the villagers still now.



Tree katte also practiced by the people where they keep idols under the tree and worship. The tree kattes in the village will be near to the temple and acts as a community space for the villagers and is a place of folklore stories about the village history and culture. There is the Katte Pooja in which ceremony, the village temple idol is taken for pooja in several Aswatha Kattes and after pooja, Prasad is distributed by the devotees who maintain the Aswatha Katte . It is also known as Nagara Pradakshine or God's visit to people.



6.8.3. Worship of stone

Figure 6-26 Peepal Tree worship in Uppunda Gp
Source: GP Survey Group, MSAP

Nagadeva images are carved on a flat stone and implanted on a raised platform for worship. Before the Daivasthanas (Bhoothasthanas) were built, Daivas (Bhootha) used to be worshipped by implanting simple stones on the soil which represented various Daivas (Bhoothas) and fencing the enclosure with plants. Aayyada/Ajakaida Kallu (used for breaking coconut) etc. is also an object of worship. In many cases, Babbarya Daiva, Rakteshwari, Kshethrapala , etc., are worshipped in a complex by implanting a single stone for each Daivas. A specimen picture of diety made of stone and installed for worship of Daivas is given in here below.

6.8.3.1. Significance of Naga shrine in Tulunadu culture:

Nagaradhane: Nagaradhane is a custom of snake worship which, along with Bhuta Kola, is one of the unique traditions practiced by Tuluva community members. Snakes are not just perceived as deities, but as an animal species which should be respected, appeased and protected for numerous social, religious and ecological reasons. Snakes have been associated with power, awe and respect. According to Hindu mythology, Lord Vishnu takes rest underneath the shade of the giant snake, Adishesha. Lord Shiva wears a snake Vasuki around his neck.

It is tough to trace the origin of Nagaradhane, though some tribes among Tulu people claim to be of Nagavanshi descent, thus possibly snake worship was popularised by them. Though most rites of snake worship are done by Brahmins, there is not a single Tuluva family that does not have Nagabana, Where Nagadevatha is worshiped according to Aliyasantana Lineage among Tuluva's. Nagamandala, Dakke Bali ,Ashlesha Bali are different types of pooja done for snakes to appease them. All Tuluvas families: Mogaveera, Maliyali Billava ,Tuluva Brahmins, Billava,Bunts, Sapaliga/Sapalya, Madivala, Devadiga, Parava / Nalkedaye,Koraga-Harijan, Ganiga, Aachari, Tulu and Arebhashe Gowdas do worship Naga from ancient times in their respective Nagabana and Moolastanas.



Figure 6-28 Bijooru shree arekallu naga (snake shrine) in Uppunda

Source: GP Survey Group, MSAP



Figure 6-27 Prayer of their Moola (Origin) Nagadevatha which their ancestors were related to.

Image Source- <https://rcmysore>



6.9. Major landmarks in Uppunda Village:

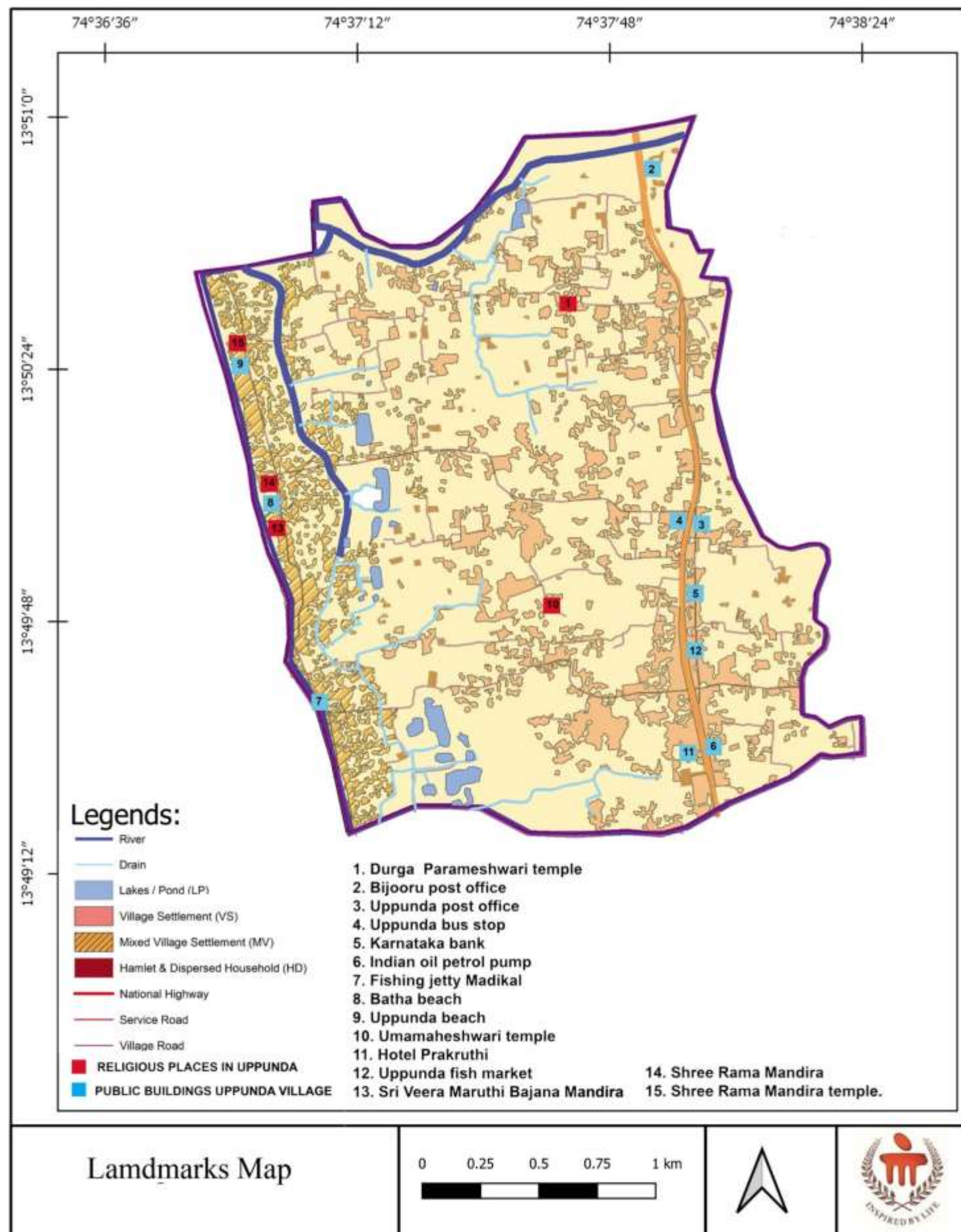


Figure 6-29 Map showing major landmarks in Uppunda village,

The map above shows location of important landmarks in the village including, Madikal beach, Batha beach and Uppunda, starting from the south. The post office and the Gram Panchayat office are situated close to the bus stand along the National Highway 66. Durga Parameshwari temple is the prominent temple in the village and is situated 500 meters from the main bus stop. There are 26 more temples spread across the village. The location of these landmarks

and existing road infrastructure gives opportunity for creating a loop connecting all these to promote and conserve cultural and natural heritage of the Uppunda.

Uppunda village is rich with many religious structure showing the bond of villagers towards religious activities and traditions. Most of the temples are small and doesn't follows the traditional styles. Durga Parameshwari temple is the prominent temple in the village. Other than temple the important attraction of the place is the beaches. Batha beach, Madikal beach and Uppunda beach is coming under village Uppunda.

6.10. Religious places in Uppunda village:

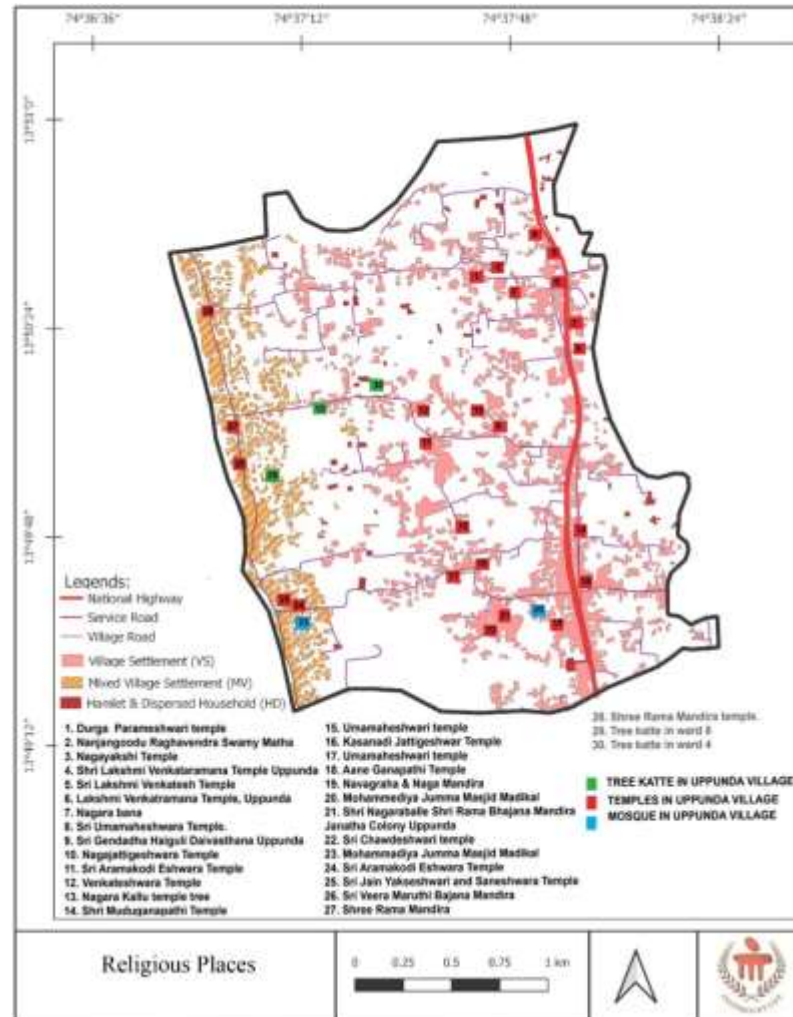


Figure 6-30 Map showing Religious places in Uppunda,

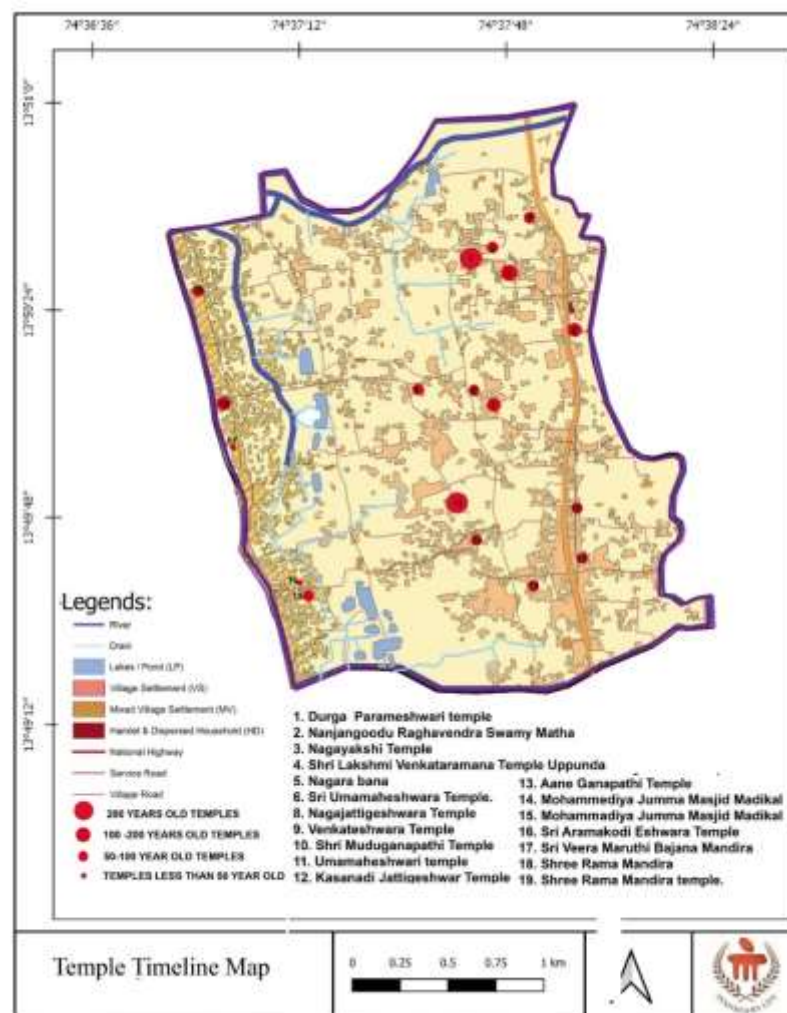


Figure 6-31 Map showing Temple evolution in Uppunda,



6.11. Annual festivals and events:

There are more than 22 festivals and events celebrated by the people in Uppunda which is similar to Mookambika temple. Some of the festivals are Kodi Habba, Ganesha Chaturthi, Shivarathri, Vijayadashmi, Shukravara Utsava etc are the few festivals. "Kodi Habba" is the famous car festival of Shri Kotilingeshwara temple at Koteshwara which is celebrated on the full moon day of Vrischika month as per Hindu calendar.

Table 6-1 Calendar of festivals and events

Festivals and events	Time of celebration
Makara Sankramana	January
Magha Maasa – Shivarathri Uppundotsava /Beach festival	February
Chandramaana Ugadi - Chaitra Shulka Paadya Sri Rama Navami - Chaitra Shukla Navami Saura Ugadi	March/April
Nagara Panchami	July/August
Simha Sankramana / Sone Arathi Bhadrapada Maasa - Swarna Gouri Pooje Ganesha Chaturthi Jeshta Lakshmi Vrata	August/September
Shree Krishna Janmashtami - Shravana Krishna Ashtami	September
Navarathri - Ashvayuja Maasa Vijayadashami	October
Karthiak Maasa - Naraka Chaturdarshi	October/November
Dhanuemaasa Special Pooja Krishna padya in Vrischika Maasa Champa Shashthi - Margashira Shukla Shashthi	November /December

6.11.1.Kodi Habba:



Figure 6-32 Aerial view at the time of Kodi Habba. source <https://www.kannadigaworld.com/news/karavali/50943.html>

"Kodi Habba" is the famous car festival of Shri Kotilingeshwara temple at Koteshwara which is celebrated on the full moon day of Vrischika month as per Hindu Calendar. It is an annual car festival and large number of devotees thronged into temple to take darshan of God. Newly married couples will come for the festivals from different places and they will take sugarcane from the festivals. This is an old custom which is still followed. Even unmarried couples find their matches at the festivals so families residing in far-off places also make it appoint to attend car festival. Uppunda's Durga Parmeshwari has the power to bless unmarried girls and fulfil wishes of couples who are praying to conceive a child so newly married couples go to the temple and take her blessings. Fishermen celebrate this festival for 10 days. Farmers also worship a lot and pray to her to protect the nature. Fishermen are busy building the chariot for the celebration of this festival. During the reign of kings, there was a custom of tying fruits and vegetables to the chariot. Farmers offer whatever crops are grown to the temple and worship her, they pray to protect the place from disaster. The cart which is used for the festival is the second biggest cart in Udupi. Sugarcane business will be at the brisk during the festival as it is customary for the people to take sugarcane sheath after the festival. The Bamboo Kodi, Tandaveshwara Lord, Trishul, Gole God and Kotilingeshwara Utsava idols that were brought from the temple in a grand procession were welcomed by the devotees with chants of mantras. First the Bamboo Kodi was taken above the chariot which signifies that the chariot is hoisted. Later the idols of Tandaveshwara and Gole were placed on the chariot along with the Trishul (Trident).

6.11.2. Uppundotsava or Beach festival

Uppundotsava is a beach three-day festival that takes place at Madikal beach in Uppunda and is celebrated on the mid of February. Madikal beach is situated on the west coast, nearly 3 km from NH66. During the festival, Sand art and cattle exhibitions take place. Additionally, activities such as kite flying, exhibition and sale of kites also are an important part of the vibrant event. The programme is aptly titled as 'Mane Mattu Mathe' aimed at conserving and holding high the age-old customs and traditions added to the attraction of the festival. Uppundotsava is held under the leadership of Uppundotsava Samiti honorary president to attract the devotees coming for shivarathri. This fest provides everything like art, sports, music, dance, food, entertainment etc at one place. This provides opportunity to promote local food, art and culture while creating income generating opportunities for the locals. The map below shows location of Madikal beach and its close proximity to the national highway.



Figure 6-33 Uppundotsav happening at Madikal beach.
Source: <https://www.daijiworld.com/news/newsDisplay.aspx?newsID=652807>

6.12. Culture and lifestyle:

The culture and lifestyle is based majorly on fishing activity which is the primary occupation of the place which is considered as the major attractions of the place. Agriculture is the second common occupation in the village. They follow many traditional practice along with their traditional occupation. Kadiru habba is celebrated by the villagers by cutting the first harvest. Kadiru habba is celebrated in coastal Karnataka and Udupi regions of the families that is engaged in agriculture with the purpose of thanking the god for paddy yields. It is believed that the coconut farm in the coastal area is due to the mercy of Kolluru Mukambika.

Hence the coconuts are used by the people only after offering the first yield to the temple Treasury of Kolluru Mukambika, practiced even now. After the rainy season, before starting fishing, in the month of August, in the leadership of Kadri Jogimatt Guru, they offer milk to the sea. The people



Figure 6-34 Yakshagana,

Source - thesouthschool.edu.in



in the village are god fearing and strongly believes to follow and practice the traditional customs and rituals. This varies with different community in the village. Along with this many festivals are celebrated yearly and these festivals and celebrations gathers all families in the villages. About 38 festivals are

celebrated by the villagers annually. They follow the system of aliya kettu. In this system the property of a family descends in the female line. Here the son enjoys the family properties as long as he is alive. This system is followed in some families to make women independent as far as the property right is concerned, in the sense she is equal to a man.



Figure 6-35 Fishermen community in Uppunda.



Figure 6-36 Kadiru Habba celebration,

Source: <https://mangaloretaxi.com/mangalore/beaches/uppunda-beach-near-baindur/>

Source - <http://vsomayaji.blogspot.com>

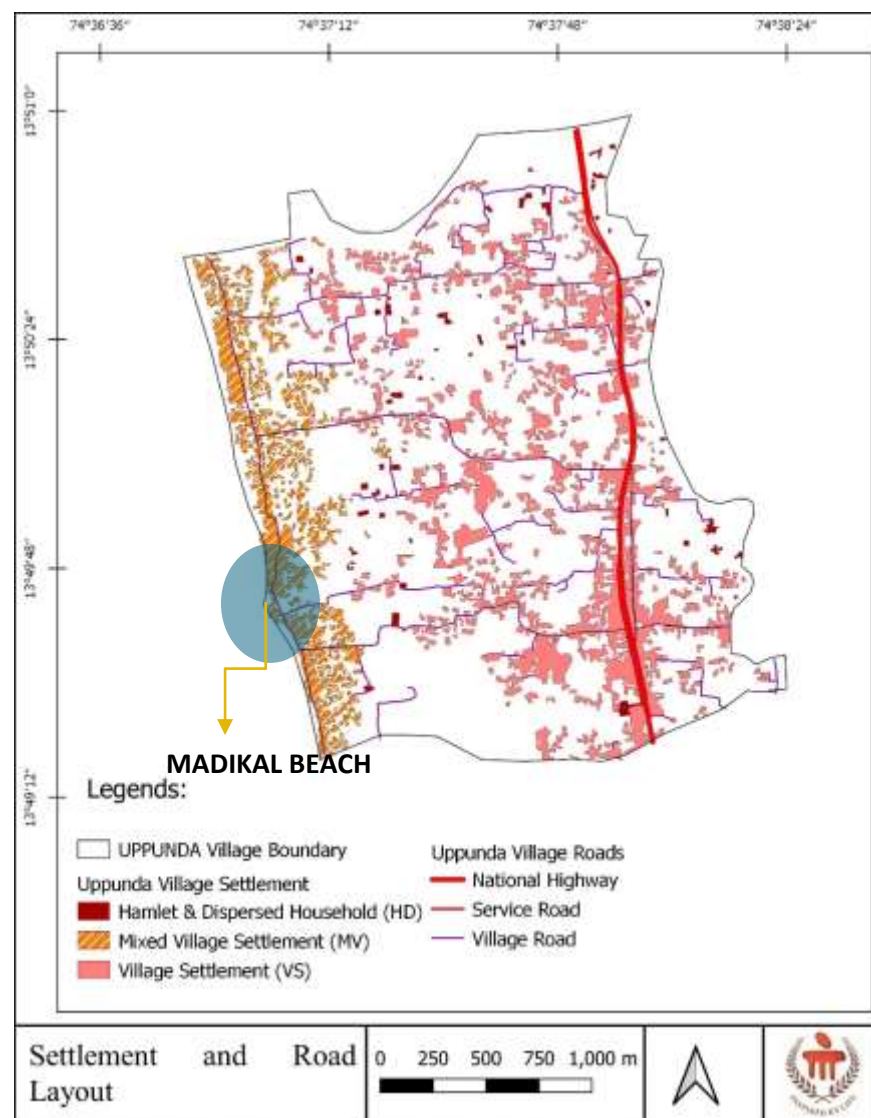


Figure 6-37 Map showing the Madikal beach area where the festival Uppundotsava is happening

6.12.1. Cage-Culture Practices in Uppunda Region:

Economic Liberalization Policies started in 1991 opened up another chance for the growth and development of Marine culture. Land contiguous estuaries and abutting waterways was changed over into modern shrimp farms during the mid 1990s. With an increase in demand and declining fish supply from inshore areas, the farmers started venturing into small-scale mariculture enterprises through cage culture and other culture systems. Inspired by the open-sea cage culture demonstration by (CMFRI) The Central Marine Fisheries Research Institute, In Uppunda, a few artisanal fishers attempted to set up rectangular cages in estuaries, which is a relatively more stable and also freer from wave action.

6.12.2. Organic aquafarming initiatives in Uppunda:

The coastal and estuarine areas of Karnataka are ideal for developing scientific mussel farming primarily due to the abundance of natural seed resources. Several training and demonstration programs were conducted by CMFRI for disseminating the technology in Karnataka with the involvement of local fishers and shrimp

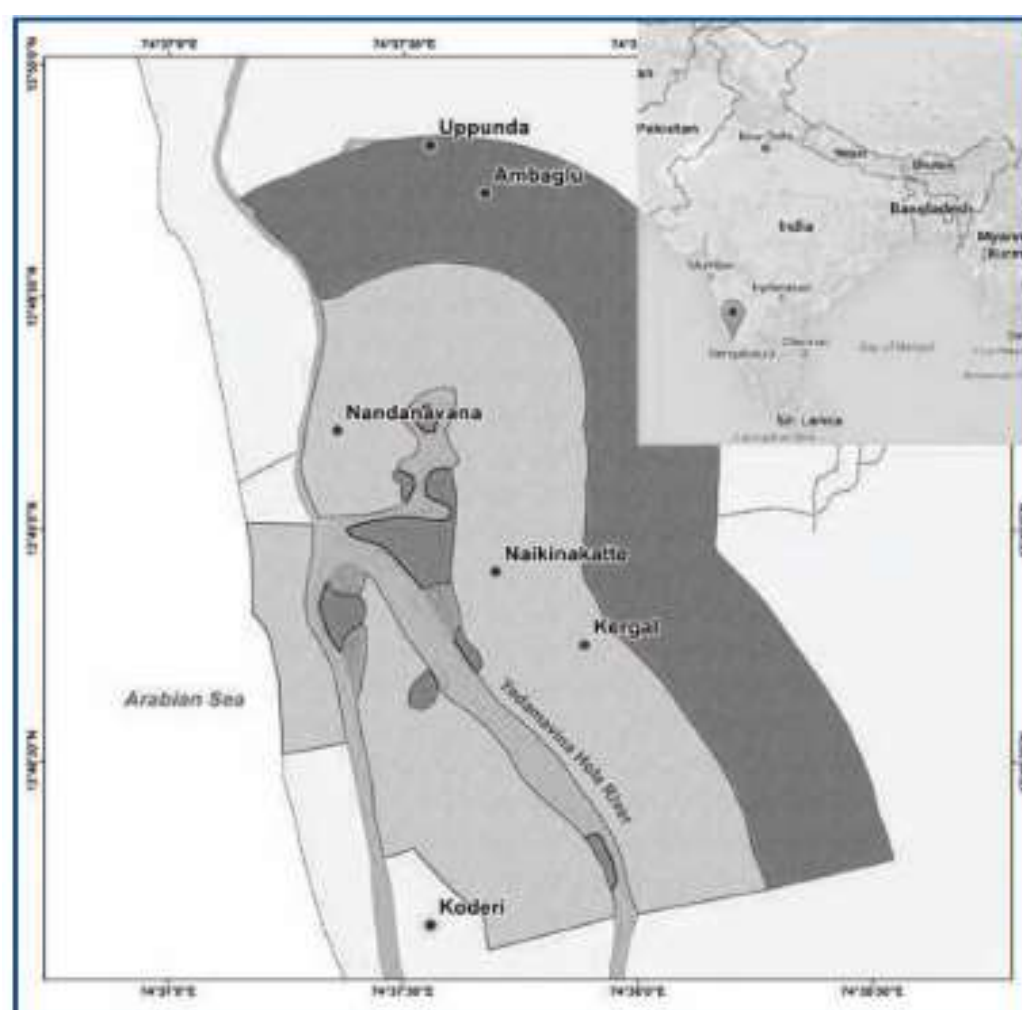


Figure 6-38 Communities and coastal area of Karnataka, India. involved in small-scale cage culture of Asian seabass. Source: (Ail & Bhatta, 2012)

farmers Uppunda. These farmers were part of the group exposed to the CMFRI-demonstrated Capture Based Aquaculture technology in Uppunda. The development of cage culture started in 1800 in Southeast Asia and modern marine cage farming dates to 1950 with the culture of yellowtail. With a small introduction of four cages during 2009, the number of cages increased to around 40 cages in the Yedamavina hole. Uppunda region currently has 23 fishers practicing cage culture in estuaries. CMFRI demonstrated participatory open sea cage culture in Uppunda and obtained a harvest of 2,085 t of sea bass. Dineshbabu (2012) showed in detail about capture-based aquaculture in estuaries in Karnataka and the considerable potential to develop cage farming in 8,000 ha of backwaters and studied the adoption of sustainable capture-based aquaculture by traditional fishers in Uppunda(Sasikumar et al., 2010)

6.12.3. Harvesting and marketing:

Harvesting begins after 18 months, generally during June-July, when fish reach 2-3 kg. Cages are taken to shore and hauled from the water. Harvesting requires around 20 labor-days for lifting cages, dragging to the shore for 2-3 hours and loading fish into a truck. The average harvest rate was 800-900 fish with a stocking density of 6,000 fish, but survival was as low as 20 percent. Marketing agents from Goa and Karwar came



to the site and bought seabass at US\$ 5.22-5.96/ kg. Marketing channels directly linking producer and consumer can ensure better returns to the cage farmer.(Ail & Bhatta, 2012)

6.12.4. Family-based farming cage:

Cage culture activities in Uppunda involve mainly family labor and activities that added to routine household chores. Everyone in the family has specific roles, including cage construction, feeding, and maintaining the cage. Another could compensate for the absence of one family member. Many fishers practicing cage culture formed small groups to procure fingerlings and fetch fish wastes from the market. Because the market value for seabass is high, cage culture resulted in a good income. Cage farmers market during the lean season of marine fishing, when there was a high demand for fresh fish, helping them earn more value for the fish. Cages also act as fish aggregating devices, and fishers could harvest a larger quantity of fish beneath cages. (Ap, n.d.)(Ail & Bhatta, 2012)

6.12.5. Religions

It is observed that Hinduism was in existence in Tulunadu since ancient times. The original Shaiva temples, after coming under the influence of Vaishnawa cult became Harihara Kshetras. Few of them became Vedic deities and others as security guards of their deities. This is clearly evident in the inscriptions of Uppunda. The images of Buddha found at Muloor and Barkur, and the remains of Buddhist Chaityas found in Ankadakatte (in Kundapura) testify that Buddhism was widely spread in the distri

6.12.6. Castes:

A variety of castes and sub-castes are found in this district. The caste-groups found in Dakshina Kannada district are also seen in Udupi district. Hence many resemblances across these caste groups in terms of their origin, occupation, custom and traditions are common. Regional variations are less. Kudubi, Kharvi, Bunt, Billava, Mogaveera, Nayari, Gauda Saraswata, and Brahman population is more in this district. Schedule Caste (SC) constitutes 1.67 % and Schedule Tribe (ST) were 0.10 % of total population in Uppunda village.(Shodhgangantrouction, n.d.)

6.12.7. Communities in Uppunda :

The main Fishing communities are **Kharvi, Harikanthas, Devadigas, Poojaries** and most of the other people in Uppunda practicing fishing presently. **Konkan Kharvis** are found along the canara coast and constitutes majority among the fishing communities in Uppunda. They are salt water fishermen and are good sailors. They also work as labourers and house servants. The women work themselves in spinning hemp and selling fish. These are migrated people from Kharva region of Gujarat are called as Kharvis. They were soldiers during Vijaynagar and Keladi rule. Now they have taken up fishing as their main occupation. They generally live in groups by constructing small huts near the sea or river banks. There are Kannada Kharvis and Konkani Kharvis. This community is not found in any of the other occupations as they are more committed to their traditional occupation. Their custom is similar to that of Moghaveeras. Kharvi women play an important role in the marketing and preservation of fish traditionally. Even though the transportation and refrigeration have considerably improved the livelihood of selling fish, these facilities also make it possible for big fish shops to sell fresh fish, thus threatening the fisherwomen's livelihoods. They have their own Cast Panchayat. And have their own community head men are named as Hedge or Patel.

6.13. Analysis and inferences

The people in the village have strong sense for the culture and its protection. This should be promoted and encouraged by enhancing the places of religious importance such as tree katte, stone worship shrines, etc. Improving proper infrastructure will enhance the safe liveable community in the village. Moreover, in new developments can take place

based on the location of existing infrastructure location such as institutes, health clinics, commercial area and public transport facilities.

Improving tourism in the village will help in enhancing the importance of heritages as well as other cultural elements of the place. This can also provide alternate employment opportunities for the community in off-season and helps in generating income for local government. Any further development in the village should provide assurance to the people which will not deteriorate the cultural and heritage aspects of the place. Even though they engage and coordinate in the social gatherings neighbourhood level interactions are very less. This should be enhanced to tackle various anti-social activities happening in the villages. Proper community awareness should be given for the growing children in the village to make them understand the importance of inherited occupation and culture identity of the place.

Table 6-2 Showing the inferences, Source: GP Survey Team, MSAP

Conservation of Cultural heritage	<ul style="list-style-type: none"> • Connecting the natural and cultural heritage • Creating sociable community spaces - enhancing worship spots and well area • Awareness about mythological, historical and religious information of the village
Tourism & Income Generation	<ul style="list-style-type: none"> • Heritage zone & Beach Tourism • loop to connect religious places and beach, providing selling platforms for local products
Enhancement of Key features/Events	<ul style="list-style-type: none"> • Religious places, institutes and other infrastructure • Conservation of local food culture, ritual practices,



6.14. Key Strategies

Table 6-3 Showing the Key Strategies

OBSERVATION/ANALYSIS /INFERENCES	POLICIES/GUIDELINES /SCHEMES AND STRATEGIES
<p>The presence of small temple and Bhajana mandir is abundant in the village. Every neighbourhood level have such social space which should be encouraged in a proper manner by promoting community participation.</p>  <p>Figure 6-39 Map showing demo area in Ward 7.</p>	<p>Support center can be developed in the neighborhood level. This can be developed near to any temple or Bhajna mandir. This can be used as a place for providing awareness about protecting cultural rituals and heritage management through digital display system.</p> <ul style="list-style-type: none">- This center can also be provided with computer internet facilities to children in the neighborhood level and also, can give health awareness.- This support centers can also help them to give alert to the villagers at the time of any emergency.
<p>The villagers culture has significance with the Naga temple. They offer flowers and areca nut palm to the deity to avoid obstacles. Such heritages in the village should be managed along with the traditional tree in the temple.</p>  <p>Figure 6-40 Nagabhana of Uppunda village,</p>	<p>The condition of the temple structure should be well maintained.</p> <p>Policies should be framed for the protection of traditional trees and Naga bhana to avoid the situation to become vulnerable.</p> <p>Awareness about the heritage management and preservation of Naga bhana can be exhibited in the form of street art. Also, the evolution of such heritage structures can be explained through such street arts.</p> <p>Heritage loop of the Naga bhana should be strengthened with the other prominent temples</p>
 <p>Figure 6.41 Ratha decorated with harvest from farmers.</p> <p>The people in the village are so much dedicated to the traditional practices and rituals. This in-turn help in maintain the natural environment and also help in following sustainable way of living.</p>	<p>Giving awareness about the people how such practices help in maintaining sustainable way of living.</p> <p>Such awareness should be portrayed at the time of festivals and famous events to exhibit the cultural richness of the place.</p>

7. Socio-economic-political structure- Desa

7.1. Introduction

Udupi is one of the three coastal districts of the state. Along its southern border lies Dakshina Kannada district; Uttara Kannada lies to the north and Shimoga and Chikamagalore to the east. Arabian Sea forms its western boundary. The total geographical area of the district is 3575 square kms. Udupi district is along the coastal with National Highway area has the maximum population and the highest density. The socio- economic parameters of the district are summarized in Table- 7.1. Also, it is the region with minimum WFPR and highest literacy rate All these indicators suggest a trend towards urbanization in the region. Also, it's suggestive of strong linear development of the district.

The smaller settlements (population <2000) are showing a slow growth rate and even negative growth rate in some taluks. The population ranges 5000-10000 and > 10000 are the ones showing the highest growth rate; meaning the smaller settlements have remained small and larger settlements have become even larger during the last decade.

The agricultural labourers and cultivators are decreasing with the increasing size of the villages, the amount of workforce in others and household industries increases with village size. All the above indicators point towards an urban character creeping in these villages. Around 80% of the villages of the district are bigger in size according to the population. The average size of settlement comes out to be 3653, while the settlement per 1000 population is 0.27. Also the urban to rural settlement ratio is 1:41. These characteristics suggest a good distribution of settlements within the district. Generally, literacy rate is increasing with size of the village. Also the sex ratio shows a decline as we go towards larger villages. Most of the migration is out migration that too outside the country. The migration may be occurring due to lack of employment that too wage employment as district has no large and medium scale industries. Industries proposed growth is decadal i.e. @10% from 2001-2011, @5% from 2011-2021. This is because the major industry being food and beverages is mainly dependent on agricultural produce, which will reduce over the years.

SOCIAL AND ECONOMIC ASPECTS	
PARAMETERS	NUMBERS
Area of Udupi District in sq km	3582
Total Population	11,77,361
Male population	5,62,131
Female Population	6,15,230
Rural Population	8,43,300
Urban Population	3,34,061
Population Density	329
Population in the age-group 0-6	103160
Fisher man population	1,26,112
Active Fisher man population	50,444
Co-operative & agricultural market	53
Industry(rural)	4.5%(M)
Agriculture(rural)	17.6%(M)5.6%(F)
Trade(rural)	17.3%(M) 0.7%(F)
Service(rural)	11.6%(M) 2.6%(F)
Skilled labour(rural)	2.6%(M)
Transport(rural)	1.4%(M)
Animal Husbandary(rural)	1.1%(M) 0.7%(F)
House wife(rural)	63%(F)
Retired(rural)	7.7%(M)
Student(rural)	25.9%(M) 27.2%(F)
Scheduled Castes population	75,429
Scheduled Tribes population	52,897
Literates	926429
Literacy Rate	86.24%

Table 7-1 Socio-Economic Aspects of Udupi District

SOURCE: District Census Handbook, Udupi, KMHA, 2011

7.2. Socio-economic Vulnerability

Vulnerability is often reflected in the state of the economic system as well as the socio-economic features of the population living in that system. By considering climate change relevant parameters, vulnerability index at district level was computed based on the following dimensions: Demographic Social Vulnerability, Occupational, Agricultural, Climatic variability.

The index attempts to capture a comprehensive scale of vulnerability by including important indicators that serve as proxies. The data from Karnataka at a glance to calculate the composite vulnerability Index across the districts of Karnataka. Thus, computed Vulnerability Index of districts across the state is given in Figure 7.1.

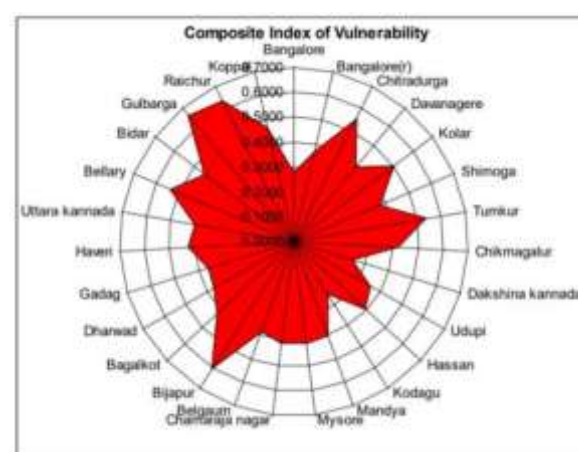


Figure 7-1 Composite index of Vulnerability across Districts of Karnataka



Table 7.2 shows the value of the vulnerability index of Udupi districts of Karnataka with vulnerable rank of 24. In the table rank 1 shows maximum vulnerable district and the vulnerability increase as we go on increasing the rank. In Karnataka, Gulbarga district is the most

Table 7-2 District-wise Vulnerability Indices of Karnataka (Source: Karnataka Climate Change Action Plan)

District	Index of Demographic and Social Vulnerability	Rank	Index of Occupational Vulnerability	Rank	Index of Agricultural Vulnerability	Rank	Index of Climatic variability	Rank	Composite Index	Rank of Composite Index
Udupi	0.2592	27	0.5103	10	0.5320	10	0.1207	23	0.3555	24

vulnerable district when we calculate the composite index of a few important indicators such as demographic and social, occupational, agricultural and climatic indicators. According to the composite vulnerability index, Dakshina Kannada is the least vulnerable district of Karnataka. After developing Composite District Level Vulnerability Index, for identification of suitable interventions at district level and sector wise, dependent population in various economic sectors was considered.

7.2.1. Gram Panchayat Human Development Index

Analysis of the Human Development scenario across 5898 Gram Panchayat, for which data was available, indicates that almost equal number of Gram Panchayat are performing above and below the state average GPHDI figure of 0.4392. All the Gram Panchayat located in the districts of Bangalore Urban, Dakshina Kannada and Udupi are above the state average HDI figures. All the Gram Panchayat in Yadgir district are below the state average HDI figures. Apart from this the other districts that are performing poorly are Bagalkot, Bidar, Gadag, Kalburagi, Raichur and Vijayapura districts where more than 90 per cent of the Gram Panchayat were below the average HDI figures. The percentage of Gram Panchayat of Uppunda performed above the average figures are given in the following:

Table 7-3 Human Development Index Uppunda (Human Development, Performance of GP's in Karnataka, 2015)

District	Taluk	Gram Panchayat	Standard of Living Index	Rank in the state	Health Index	Rank in the State	Education Index	Rank in the State	HDI	Rank in the Sate
Udupi	Kundapura	Uppunda	0.2132	781	0.9758	2796	0.6988	1748	0.5258	758

7.3. Social- Economic Conditions of Uppunda GP.

7.3.1. Demographic dividend in Uppunda

The total population of Uppunda being 11456 (Male: 5557, Female: 5899), with 37% of the population in the working age group and 63% being non-working population (Figure- 6.2), Uppunda has the opportunity to achieve faster economic growth through a favourable demographic dividend, provided that appropriate skills are imparted to the non-working and the literate population in general and youth in particular. Skilled persons will then be able to find employment in the state as well as

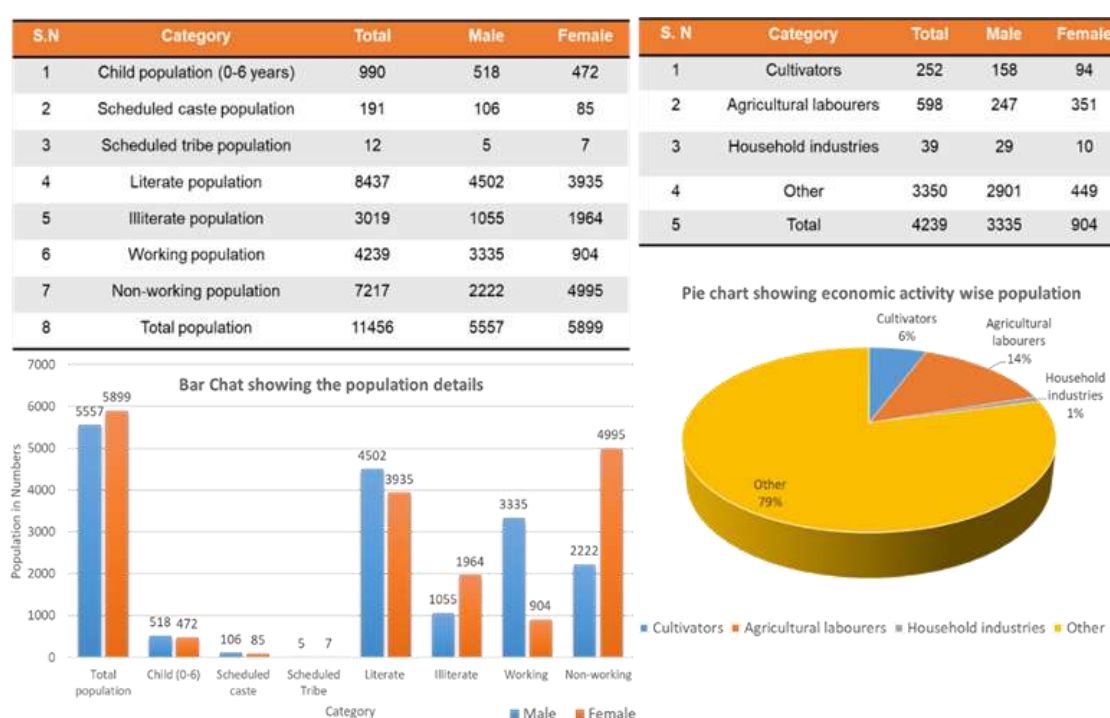


Figure 7-2 Demographic dividend (economic activity wise) in Uppunda

(Source: District Census Handbook, Udupi, Directorate of Census Operations, Karnataka Ministry of Home Affairs)

outside (including other states), where there is demand for them. The proposal shall thrust more towards informal workers, particularly those belonging to the categories of SC, ST and OBC (minorities) and women, resolving social and gender inequalities in access to employable skills and, thus, decent jobs. During the survey, it was also found that general education up to higher secondary level does not substantially lead to youth being employed in formal sector. Changes in higher-secondary curricula are expected in pursuit of vocational skills to increase career opportunities in the formal sector.

7.3.2. Main and marginal working population in Uppunda

The major working population in Uppunda is mainly engaged in cultivation and agricultural practises which is nearly about 30% whereas 6% of them are working marginally (Figure 6.3). These 736 marginal workers in the village are also unemployed for rest of the months which seeks the need for skill development opportunities to promote employment amongst these people. The proposal must aim at providing employable skills to women, especially those engaged in unpaid labour, and empowering them to take up supportable jobs.

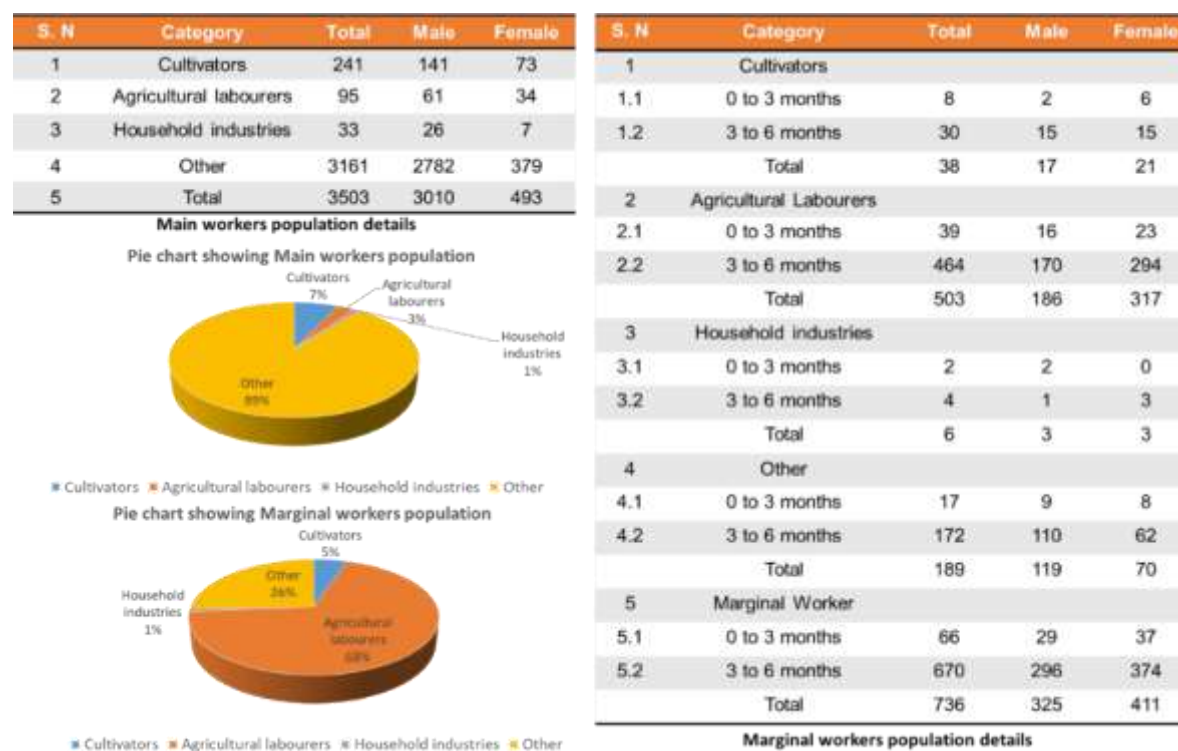


Figure 7-3 Graph depicting main and marginal working population in Uppunda

Again, the percentage of self-employed and wage-employed

(Source: District Census Handbook, Udupi, Directorate of Census Operations, Karnataka Ministry of Home

women is poor relative to men owing, among others, to poor enrolment in vocational educational institutions. Therefore, the legislation should aim to make vocational training organisations responsive to woman candidates' needs.

7.3.3. Socio- Economic infrastructure

The socio-economic infrastructure of Uppunda is summarized in Table – 6.4. It is observed that local men in the village leave their education after SSLC, and get into fishing business, whereas the women, prefer to continue their higher education and get into professional degree courses. As the women population of the GP are highly qualified, they do not prefer to marry men of lower education background and hence there is lack of female population for the men in the GP, which is also creating an imbalance in the society. Due to lack of job opportunities, people with higher education migrate to cities and also due to migrated labours from the North, in interest to the high wages. There is no provision for higher education, hence people need to travel to Kundapura. Female oriented occupations are absent in the village and they are not allowed to travel outside of the GP for employment. Primary occupation of the people in this village is based on agriculture and fishery. It is observed that there are no college available after 12th standard which make it difficult for the youth to pursue higher education. The employer of different shops teaches tailoring and welding etc. at their respective shops to the employees. Traditional Net weaving is practised in few houses. There are few people in the village who work as Coolie/ Manual labour on daily wages. In ward 3, For Vocational Training Centre people need to travel till Kundapura. For Tailoring Training Centre,



Figure 7-4 Economy Aspects of Wards in Uppunda



they have to travel about 5km from the Panchayat. There is a Cloth factory in Ward 3 which has helped women for employment While the other women sell fish. Education should be is intended towards job opportunity for the youth in the village. Skill development and Vocational Training Centre can be planned in the village to create employment opportunity for the residents of the panchayat. Besides providing skill development centers for the youth, panchayats should also focus on enabling the youth to set up self-employment units. Agriculture and fishing is the main occupation (Figure- 6.4). In Ward no 10 very few people engage in coconut selling and few women engage with household work. Off season fisher man are facing problem due to lack of alternative work opportunities. Most of them are fishermen while few do coolie work and other odd jobs. Few ladies work as helpers at various houses. There is a need for Job opportunities for fishermen during off season.

CAGE FISHING – subsidy given during installing but no further training given. Approx. Rs. 70000- 80000 required to set it up Food to feed the fishes are bought from market or leftovers given. Fish links are bought from Andhra Pradesh. Failure rate is higher (fails due to saltwater or dirty water). A fish pond or any controlled water system could be suggested.

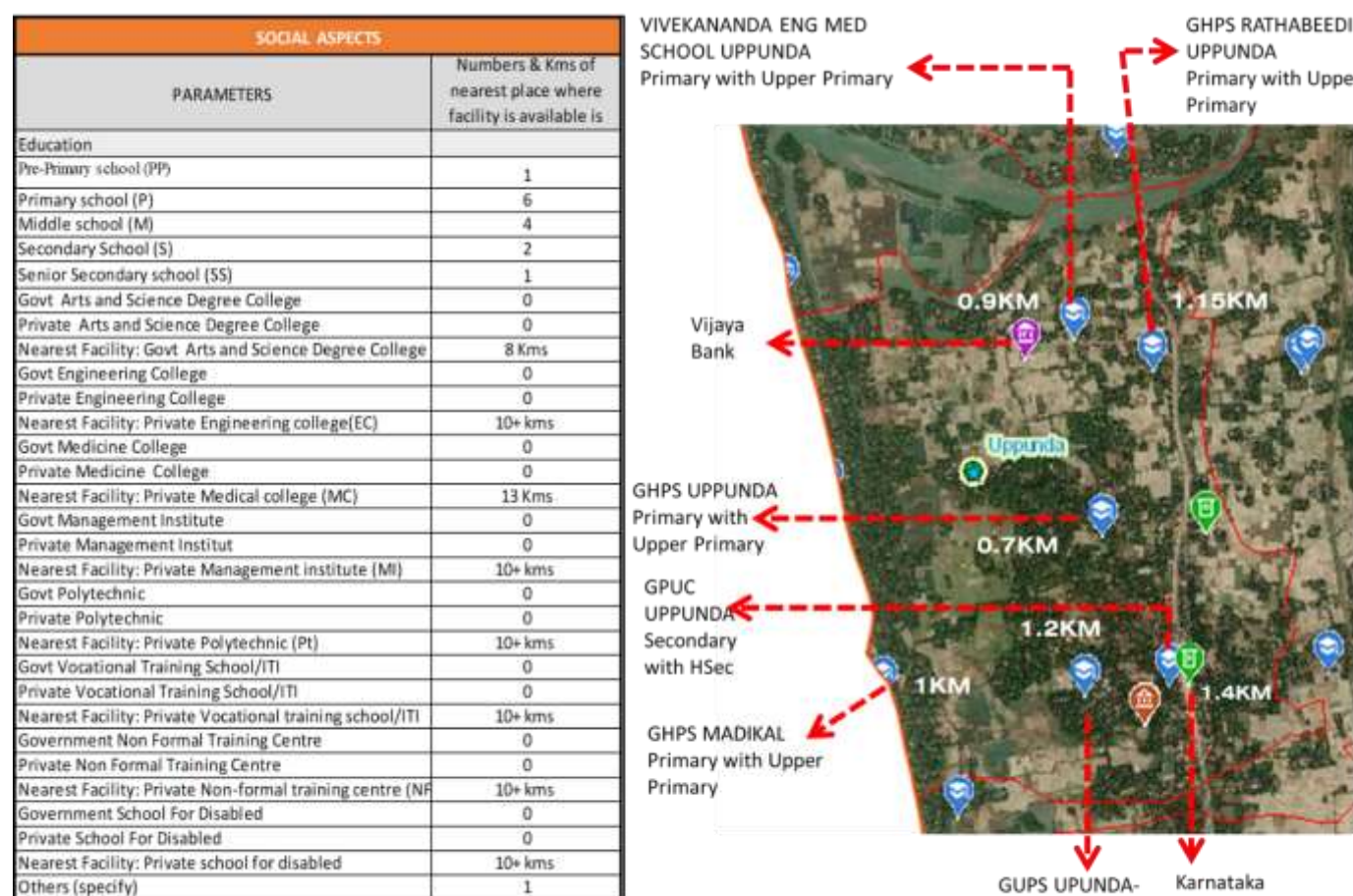


Table 7-4 Socio-Economic Infrastructure of Uppunda. (Source: District Census Handbook, Udupi, DCO, Karnataka Ministry of Home Affairs)

The other related infrastructures of Uppunda Village in shown in Figure 6.5. They have to travel to Kundapura for serious medical attention. There is no specialty hospital for this village people are dependent on Manipal or Udupi. No health scheme with the local clinic. Health centers clinics lack good facilities in the village. There is a need for Better health facilities in proximity. River, canals, tanks, lake and ponds are not available which lets to shortage of water during summer. Well is the Main source of water for everyone but they do not have alternate sources of water during summer season when there is a shortage in well water. In ward 8 since it is beside the coast. Water from the well is salty. In few places, as Per observations 12ft in wells would be normal water. Deeper than that would be salty water. Therefore, they use Panchayat Water. Road connecting to individual houses doesn't have a proper road connection. Most of the roads connected from main road to houses are kuccha roads. The interior mud roads get flooded with water during rain which makes it difficult to access. Bus transportation is available and are connected to different places with good frequency. Nearby grocery stores required. In Ward 10 Most of them have toilets outside. While few of the toilets were actually a little far away. There is no college after 12th standard for higher education.

7.3.4. Skill Levels among the youths in Uppunda GP

As the prospects of formal jobs increase when a young person has technical education, the degree to which vocational skills are offered to youth in Uppunda must be investigated. Skill provision policies for youth, particularly women and those from SC / ST groups, must be adopted. The number of women receiving vocational training is slightly smaller than men because they have to drive 5 kms to Kundapura. Similarly, relative to other castes, the proportion of youth receiving vocational training is poor among ST and SC castes. The data provided by the Karnataka Knowledge Commission shows that the three sectors that provide most of the employment to the skilled workforce are: i) Tourism; ii) Information technology, biotechnology and environmental sciences; and, iii) construction (Figure- 6.6). As per their report, five sectors that will employ the skilled workers are: a) Information Technology and Information Technology



Figure 7-5 Other social infrastructure facilities in Uppunda

(Source: District Census Handbook, Udupi, DCO, Karnataka Ministry of Home Affairs)

Enabled Services (IT & ITES); b) health care services; c) education and skill development, d) building, construction industry and real estate; and e) tourism, travel, hospitality and trade. Skill Development planning must emphasise these industries. There is a lack of formal skills training facilities in sectors that are likely to hire more employees in the coming years, such as agriculture & allied, building, construction and real estate, tourism, travel, hospitality and commerce, shipping, logistics, warehousing and packing, and health services. The strategy will therefore concentrate in the coming years on developing institutional facilities for vocational education in construction, tourism, travel, hospitality, transportation and healthcare.

7.3.5. Target segments for Skill Development and Vocational Training

Uppunda 's skill development proposal would concentrate mainly on 16-35-year-old youth. Many over 35 years old, though, are not exempted from this scheme. The goal group of 16-35-year-old youth would consist of:

- Secondary or higher education students interested in learning technological or non-technical knowledge through ITIs, polytechnics and other formal institutions.

Sectors	Number	Percentage
Tourism	50,00,000	30.12
Information Technology/ Biotechnology, Environmental Science	40,00,000	24.10
Construction	20,00,000	12.05
Human Resource exports	15,00,000	9.04
Education	10,00,000	6.02
High-Tech Industries (Small and Medium)	10,00,000	6.02
High-Tech Agriculture/ Gardening, Animal Husbandry and Food Processing	10,00,000	6.02
Health care	5,00,000	3.01
Banking, Finance, Insurance, etc.	3,00,000	1.81
Textiles	3,00,000	1.81
Total	166,00,000	100

Figure 7-6 Major employment sectors as per skill development by 2030
(Source: Karnataka Knowledge Commission, Vision 2030)



- Drop out school before completing secondary education, involved in learning technological or non-technical knowledge through informal and formal institutions.
- Informal workers and young homemakers interested in learning new abilities, retraining or abilities by formal or informal organisations based on their academic qualifications and experiences.

7.3.6. Context for Skill Development Policy

The government of Karnataka had established the Department of Skill Development, Entrepreneurship and Livelihood in 2016 which enables the state's youth to acquire necessary skills for employment and livelihood promotion. This Department aimed to: i) provide skills to youth in mission mode for new and better employment; ii) converge all skill-related programs/schemes under one department for better coordination; and iii) act as a nodal agency to provide industry interface, quality benchmarks, national/international best practices, monitoring and impact evaluations. This Department undertakes the functions of planning, regulation, standardization, promotion, implementation and monitoring of all skill development initiatives in the state. (Source: KSDP, 2017).

Sustainable Development Goals: The skill development policy becomes important in the context of the Sustainable Development Goals, which call upon governments to substantially increase the number of youth and adults having relevant skills, including technical and vocational skills for employment, decent jobs and entrepreneurship by 2030.

Constitutional Provisions: The policy is in line with the Constitution of India, which places the education, including technical education, vocational training and technical training of labour in the Concurrent List (Article 246). The policy is also in line with the National Apprenticeship Act of 1961.

National Policy: This policy is formulated to complement the vision of National Policy for Skill Development and Entrepreneurship 2015. The National Rural Livelihood Mission's Framework is also taken in to cognizance. The provisions of the national policy and programs are adopted and included here in letter and spirit. (Source: KSDP, 2017).

National Skill Development Corporation: The National Skill Development Corporation India (NSDC) was setup as one of its kind, Public Private Partnership company with the primary mandate of catalysing the skills landscape in India. NSDC is a unique model created with a well thought through underlying philosophy based on the following pillars:

1. Create: Proactively catalyse creation of large, quality vocational training institutions.
2. Fund: Reduce risk by providing patient capital. Including grants and equity.
3. Enable: the creation and sustainability of support system required for skill development. This include the industry led Sector skill councils.

There are different schemes formulated for skill training which are Pradhan Mantri Kaushal Vikas Yojana (PMKVY), PURA-Provision of Urban Amenities in Rural Area, Mahatma Gandhi National Rural Employment Guarantee Scheme, Rashtriya Krishi Vikas Yojana, Swarna Jayanti Gram Swarojgar Yojana, Pradhan Mantri Awas Yojana – Gramin, SFURTI & ASPIRE, Integrated Rural Development Programme (IRDP), Training Rural Youths for Self-Employment (TRYSEM), National Rural Employment Programme (NREP), Jawahar Rozgar Yojana (JRY). From the identified schemes Pradhan Mantri Kaushal Vikas Yojana (PMKVY) is considered for setting up Skill development and Vocational Training centre in Uppunda. Pradhan Mantri Kaushal Kendra schemes has been identified by the village community in Zilla panchayat, Udupi – JJM Action Plan for Uppunda GP 2020 -21.

7.3.7. Skill and Vocational Development Specifics

Skills and knowledge are the driving forces of economic growth and social development for any country. However, currently only a very small proportion of India's workforce has any formal skill training. Lack of skill training facilities is also evident in Uppunda village. It is observed that large sections of the village's youth and unemployed people are looking for economic and livelihood opportunity. In this context, skill development has become a key priority area for the village.

7.4. Aims and Objectives of the Skill Development Policy for Uppunda

The Uppunda Gram panchayat aims at an inclusive skills development strategy as well as learner and productive jobs focused in its strategic approach to gain the maximum demographic dividend possible for steady, balanced socio - economic development and equitable growth, leading to decent job opportunities for all and to ensure the employability in among women, unemployed people and youth members in coastal villages of Uppunda through vocational and skill trainings centre (Figure- 6.7).

- Planning and incorporating project-based skills development, entrepreneurship and livelihood activities, integrating all relevant skills development, entrepreneurship and livelihood programs;
- Ensure economic and social participation of target groups through enabling them to learn employable skills through the development of skills infrastructure in close collaboration with business and industry associations, sectoral skills boards, civil society and bilateral / multilateral agencies;
- Standardize the curriculum in line with quality parameters and business objectives, and build skills to enhance employability and worker movement;
- Cross-sectoral and global knowledge requirements, including strong quality assurance and qualification framework;
- Ensuring the availability of qualitative expertise to harness population returns and fulfil business needs;
- Strengthen productivity and ensure long-term competitiveness of skills development infrastructure in both government and private sectors;
- Provide expertise to strengthen livelihoods and promote entrepreneurship with an increased emphasis on innovation, technology and environment.

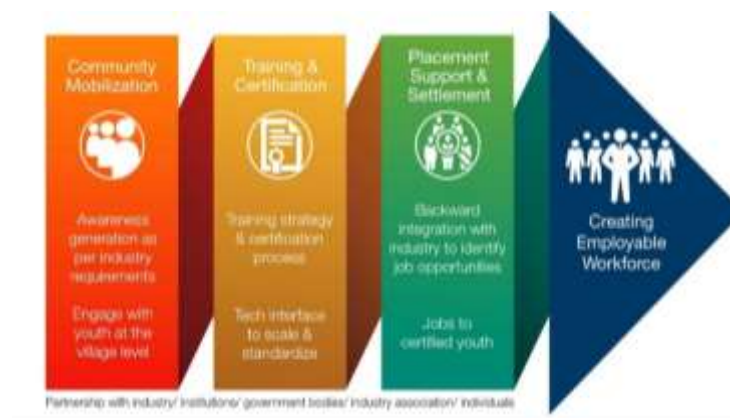


Figure 7-7 Approach for Skill Development in Uppunda
(Source: Centum Learning: Vocational Education and Training)

In order to achieve the above aims, the skill development policy of Uppunda Gram panchayat is required to formulate the following objectives.

- Provide awareness and mobilize young people, entrepreneurs and informal staff on employable skills and organizations offering those skills.
- Make vocational training idealistic both for youth and employers so that youth perceive vocational training as an employment opportunity and employers, recognize the development value of skills, and offer skilled workers remunerative employment.
- Standardize curricula in lines with quality criteria and market demand to improve quality, employability and employee mobility.
- Develop and enhance teaching facilities and instructors at all levels and deliver high-quality, effective teaching.
- Equitable and convenient access to training facilities for all vulnerable villagers.
- Ensure vocational training for school graduates, informal sector employers, low-paid employers and young homemakers to allow them to improve their employability and access growth opportunities through skills, retraining and upgrading.
- Encourage mobility between professional and general education in line with the National Skill Qualifying Framework.
- Have appropriate skills to grow entrepreneurship and secure livelihoods.
- Provide adequate built environment that meets the minimum space requirements, as per applicable category of Pradhan Mantri Kaushal Kendra (PMKK) and incorporate low cost and efficient construction technique as well as use of prefabricated construction methods for setting up of the Skill Development Center.



7.5. Strategic focus areas: Skill – Entrepreneurship – Livelihood Development

7.5.1. Policy Intervention Strategies:

Providing skills to non-working and literate communities (both stock and fresh entrants) is a giant challenge that can only be accomplished effectively by collective effort by several stakeholders. Therefore, Policy intervention strategies and roles of different stakeholders needs to be outlined.

- Emphasis on providing fresh entrants with vocational training through the full utilisation established formal vocational training institutions.
- Private sector will be allowed to extend educational facilities to fresh entrants by Public Private Partnerships (PPPs).
- Strengthening the higher education sector has the ability to eliminate fresh entrants progressively. Introducing skill courses from the eighth level would also affect the number of people pursuing qualifications. The Education Department need to primarily accomplish the mission of improving school and higher education.
- The Skill Development Department need to perform the tasks of reorienting current skills courses and making them job-oriented.

In lines with the above policy intervention strategies and functions of various stakeholders, the following policy initiatives are formulated to strengthen the capacity growth eco-system for Uppunda 's defined target community.

A. Information, Realization and Participation:

- **Develop an Information outreach and educational Framework**, along with modules and tools in Kannada, to promote awareness of the role of skills and options available in enhanced work opportunities sectors, modules and training providers. These seek to create a skilful environment for youth, parents, teachers and other stakeholders.
- **Awareness and understanding** of the advantages of qualifications, returns on skilled training, marketable abilities in vocational and non-technical trades and establishments delivering those abilities can be provided to secondary and higher education graduates, drop-outs and seasonal workers.
- **State government's contribution in developing (or use existing) online portals** for youth interested in learning skills. **Mobile apps** can be used for better social networking and better engagement with potential candidates (Figure 6.8).
- In order to explore the importance of vocational education, **institutional arrangements** can be made for those in secondary and higher secondary schools to spend a few days in pioneering programmes on ITI campuses, polytechnics, factories, advanced educational facilities and others. It will draw on realistic experience with real-world manufacturing, workplace, and service expertise.
- Gram panchayat Uppunda and **local urban bodies will provide knowledge information and mobilise youth through self-help groups** and other community-based organisations. They will also identify and enrol young people interested in acquiring skills and encourage the link between youth interested in acquiring skills and organisations providing employable skills. Existing database, such as Socio-Economic Caste Census (SECC) – 2014, can be used to classify and coordinate youth.

B. Youth Aspirations:

- To ensure a seamless integration of vocational education into the formal education system, the state government need to incorporate necessary reforms in the education system at middle and high school and technical training levels. It will also encourage seamless mobility from work to formal education and vice versa, enabling ongoing and lifetime learning for youth vocational education and training. For better options, accessibility to various talent streams and mapping abilities by aptitude testing would be added. Assessment and evaluation bodies will promote reforms of school education boards.



Figure 7-8 Kannada translator and Online portals/ Mobile apps for Social Networking (Source: The National Skill Development Corporation (NSDC))

- Courses provided under competence development will have theoretical and practical foundations for complete knowledge of personnel. This will help them pursue the same pay and promotion packages as standard private and public jobs.
- Courses such as a Bachelor of Technical Studies will continue to incorporate skills as a subject at college and university level to allow students to provide trans-disciplinary vertical mobility in those courses for a bachelor's degree. Such a course, as determined by UGC, would have several entry or exit points and relevant general education curriculum along with technical skills.
- Youth who have been to private schools, academically well performed and whose parents are reasonably well-educated are likely to allocate low rank to technical education. Customized marketing programmes for this category and skill contests will be conducted to counter the derogatory view of technical education.

C. Youth Aspirations:

- Karnataka Skill Development Agency in collaboration with the National Skill Development Agency (NSDA) to need to focus on skill regulation and quality assurance (Figure 6.9).
- The Karnataka government adopting the NSQF framework need to focus on quality implementation and integration of skill courses in accordance with national standards.
- The skill courses will be adapted or adjusted according to market demands, and needs and preferences of trainees in the state.



Figure 7-9 Collaborative Approach for Skill Development in Uppunda (Source: KSDP, 2017)

7.6. Site selection and potential for Skill development and Vocational Training Centre

Site selected for the Skill development and Vocational Training Proposal is in Mayyarkeri, Ward 2 of Uppunda village, Byndoor Taluk, Udupi District (Figure 6.10). Site identified is a Government land which has a proximity of around 1.5 km to all the wards of the village Figure- 6.11. Panchayat has a public transport facility which is Uppunda bus stop (Uppunda Shaale Bagilu) which is approx. 1 km from the proposed site. Figure- 6.12. Site has a connecting road which is a pucca road with approx. 7m width.

Site identified is a Government land following the Guidelines under Pradhan Mantri Kaushal Kendra for Setting up a skill development centre. Proposed Centre is being Located near from a major approach road which is National Highway (NH 66) and has a connecting road with approx. 7m width. Site has a proximity of 1.5 km to all the wards and 1.2 km to the public transport facility- Uppunda bus stop (Uppunda Shaale Bagilu). Proposed Centre will provide a platform for women, unemployed people and youths to enable them to take up skill training and become employable and earn their livelihood.

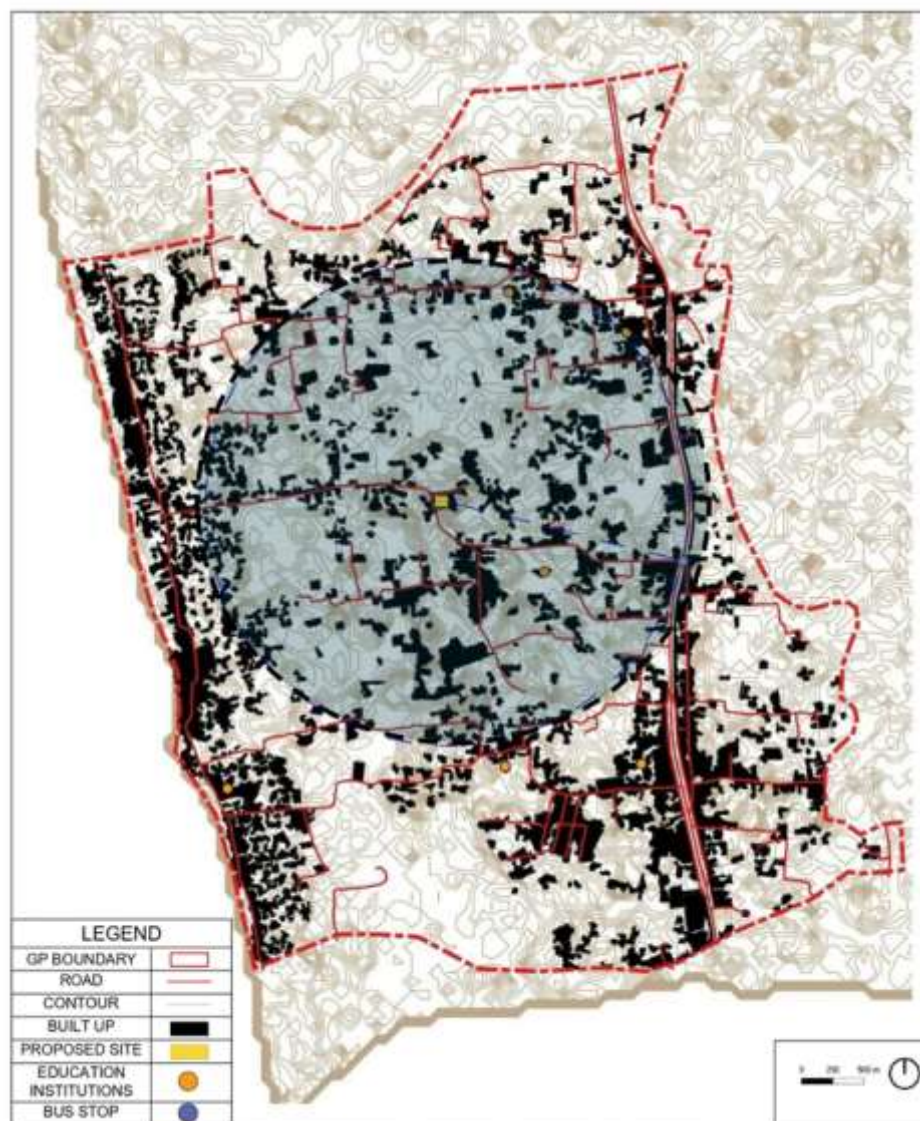


Figure 7-10 Site identification. (Source: Base data – NRSC)



Figure 7-11 Proposed Site Area



Figure 7-12 Uppunda Bus Stop along NH

7.7. Economic Development Centre in Uppunda.

7.7.1. Introduction

As the engine of economic growth and ensuring inclusive development worldwide, micro, small and medium-sized enterprises have been adopted particularly in India as the world's second most populated country. In rural India, micro or small enterprises have been traditional skills since ancient times. Recently, rural entrepreneurship has developed a dynamic phenomenon. Small and medium-sized enterprises (SMEs) have a wide scale that plays a crucial role in creating employment and revenue for rural poor and unemployed. The spectrum of rural industry is regarded essentially as a matter of using efficiently the unexploited natural and human resources and utilizing vast material existing in the countryside. Rural industrialization features low capital spending, labour density, and the use of basic technologies utilising local human and material resources. Therefore, a judicious combination of local manpower and local resource is required to bring about viable growth in these regions.

“Rural Entrepreneurship can be defined as entrepreneurship emerging at village level which can take place in a variety of fields of endeavour such as business, industry, agriculture and acts as a potent factor for economic development”.

Role of MSMEs in Rural Economic Development: Over the past five decades, Micro, Small and Medium Enterprises (MSME) has emerged as a highly vibrant and competitive Indian economy market. According to the assessments of the Ministry of MSMEs, the Government of India, the sector creates about 100 million jobs from over 46 million units located across the country and contributes 45 percent of India's total industrial workers, 45 percent of India's total exports and 95 percent of the country's industrial units and more than 6000 types of products are manufactured (As per msme.gov.in).

- **Inclusive development:** MSMEs foster inclusive development by providing employment opportunities in rural areas, especially for people from poorer parts of society.
- **Financial inclusion:** small businesses and retailers in Tier-II and Tier-III cities build opportunities for people to access banking services and goods.
- **Promoting innovation:** offers resources for emerging entrepreneurs to create new innovations that improve industry competitiveness and accelerate growth.
- **Balanced regional development:** MSMEs in rural areas monitor industrial concentration in urban areas by setting small-scale units in remote areas, effective entrepreneurship growth projects could eventually accelerate sustainable regional growth.
- **Reduction of Poverty and Unemployment:** Some MSMEs are labour-intensive, providing large-scale opportunities for rural residents. MSMEs address the increasing dilemma of rural India's large-scale unemployment and underemployment. Unemployed people can choose self-employment through rural entrepreneurship growth. Several programmes like National Rural Employment Programme (NREP), Integrated Rural Development Programme (IRDP), etc. are in service in India to support aspiring entrepreneurs.

7.7.2. Need for Economic Development Centre in Uppunda.

Uppunda village has good connectivity with highway, railways and sea. Most of the people dependent on the cultivation or fishing. But these fishermen folk are jobless during June to August due to fish breeding season. In Ward no 8, people who are associated with coolie job and marginal worker of around 736 in number, who are mostly without work on a regular basis and they don't have alternative job option for them. Due to lack of job opportunities, people with higher education have migrated to cities. Lack space in the government given land has restricted residents from practicing animal farming at a large scale. There are also not much employment opportunities for Women within the GP.

Economic development is not only associated with basic needs for individual. It also implies with sustainable economic growth and improving life. Employment and income both need to go hand in hand. This development center can create more employment in the Gram Panchayat and promote entrepreneurship in addition with further opportunities for economic growth. This village economic development center has a potential to create a focal point for the Gram Panchayat and encourage the people to lead a good life. The strategy for developing this proposal has two main aspects one is social life and another is economical life. More trading option, investment in different sector and creating market spaces not only develop the economy of the GP but also create a impact on social life of the people. Upgradation of living standard, long healthy life, woman empowerment, Knowledge development also can be encouraged. This place will have small scale industry, small enterprises-wholesale, bulk storage for crop and seeds and a common trade area where people come together for selling different items.

Strategic Development: The two main strategies that need to be followed for this designing the centre is economic and social life (Figure 6.13). Boosting of economy also enhances the quality of life. More job opportunity can enhance the woman empowerment and standard healthy life. It shall enable young and promising entrepreneurs to develop and carry out rural entrepreneurship activities. It shall also increase villagers' literacy rates. Their schooling and self-employment would improve the community's quality of living. Rural The proposal shall also help to optimise the use of local resources such as raw materials and labour for useful purposes, thus increasing productivity. Entrepreneurs use scarce capital wisely which successfully leads to an area's greater economic growth. It would result in producing more output, jobs and prosperity by leveraging new ways to increase rural people's per capita income. Improvements in local productivity through the proposal shall contribute to promote prosperity.



Figure 7-13 Strategic Development for Uppunda Economic Development Centre.

7.8. Proposal for Economic Development Centre in Uppunda.

The proposal is developed on the broad objectives for rural development strategies in lines with MSME guidelines. The proposal strives for economic development to build economically sustained within the rural landscape. The proposal comprises Economic Development Centre has 3 aspects – a) Centre space which will be accessible for all the rural people b) Creating employment opportunity by encouraging small scale industries c) Trade for agriculture and fishing industries for import and export. The planning phases includes mapping of small enterprises and identifying its potential, facilities for new start up and opportunities for employment. (Figure 7.14).

7.8.1. Small Scale Industries:

Using the word small-scale industry does not mean small industry size. It just means a limited commercial unit scale. Small-scale business estimates vary depending on the small-scale sector concept. "Modern Small-Scale" industries are those that use power and machinery. To conclude, three metrics are commonly used to calculate operation scale or firm size. Production, employment, capital estimation. Physical production, say tones, may be used to calculate firm scale. Output value can be used by multiplying the physical measure by price per output unit. The product's price

Mapping	Micro and small enterprises within the Panchayat area.
	Enterprises opportunity for the village
	Opportunities for different categories
Identification	Potential candidate to set up enterprises.
	Skill and interest of the candidates
Facility	Job opportunity
	Facilitate policy for new start up
	Support for new enterprises
	Support for woman by encouraging home based product
Maintain	Database for labors and employment
	Database for labors and employment
Create	Economical protection
	Equitable wages for men and women, zero child

Figure 7-14 Economic Development Planning, Source: Author



can vary annually. The following enlisted industries are proposed for the Uppunda Gram panchayat to create employment opportunities for the rural people.

7.8.2. Site Selection and its Potential:

Proposed site has been selected based on its major connectivity criteria to each ward catering the village population and their travel distance. The site is situated in the prime location with all the important buildings nearby accessible with a strong road infrastructure. The site has potential to catch the economic activity as it is near to National Highway (Figure- 7.15).

Proposed site is located in Ward no 5 which along with the National Highway. Most of the commercial activity is happening in this ward as all major office

buildings are present in this ward. Nearby Bus stop is within 270m so it is a walkable distance for the people. It helps interchange between routes. Edapally–Panvel National Highway is within 250m so it is easy to transport any goods from the center. 4-meter-wide road which is directly connected to the highway is in the North side of the site which can act as a service road for the proposed center. The Gram Panchayat office is also located opposite to the site. It is an important landmark available near to site and help people to get easy access to the center. Weekly market for the village also set up 600m from the site. Post office is also within 1km. It can promote parcel service and as well as sending any important document also is easy. The total site area is 2.5 acre which is a part of Government jurisdiction.

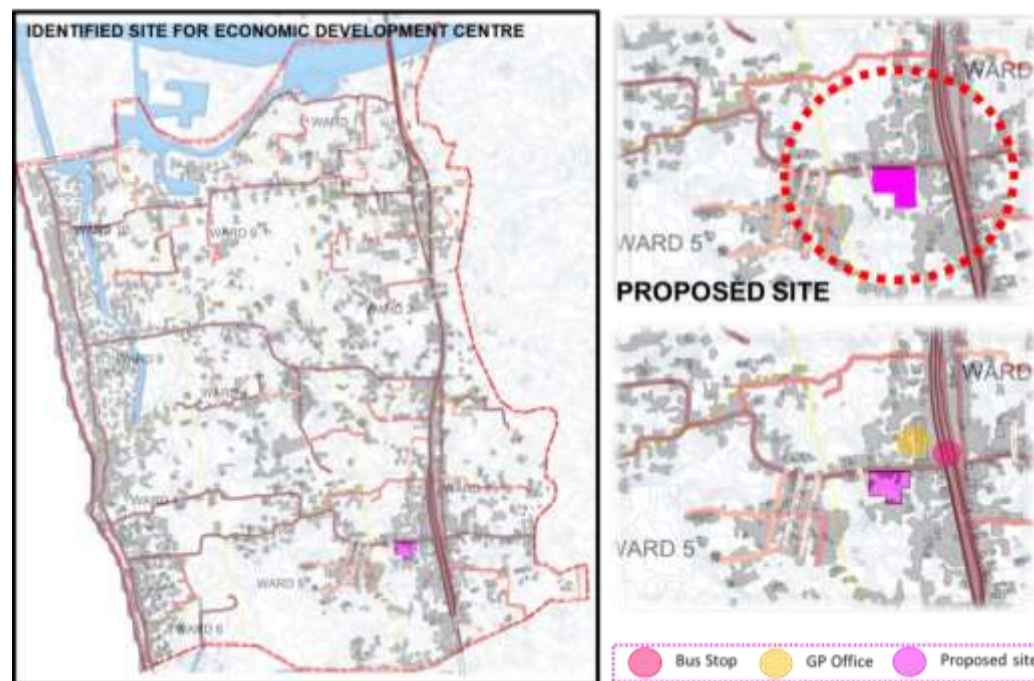


Figure 7-15 Site Identification for Economic Development Centre at Uppunda, Source: Base Map-NRSC

8. Physical Infrastructure- Desa

A residential Environment is defined as a system of setting in which system of activities take place that forms a sub-system (a dwelling unit) of the environment (Zwarts). The sub-systems are again classified based on the different parameters like the density of the dwelling units in the society. A residential environment design needs to follow all the factors that related to human comfort and human need. As per Maslow's diagram the factors are:

1. Physiological Needs: Food, Water, Air, Shelter, Clothing
2. Safety & Security : Health, Employment, Property, Family, Stability
3. Belongingness & Love Needs: Friendship, Family, Connections
4. Self-Actualization: Morality, Acceptance, Creativity
5. Esteem Needs: Confidence, Connections, Need for individuality
6. Environmental Issues : Waste Disposal, Pollutions related to air and water

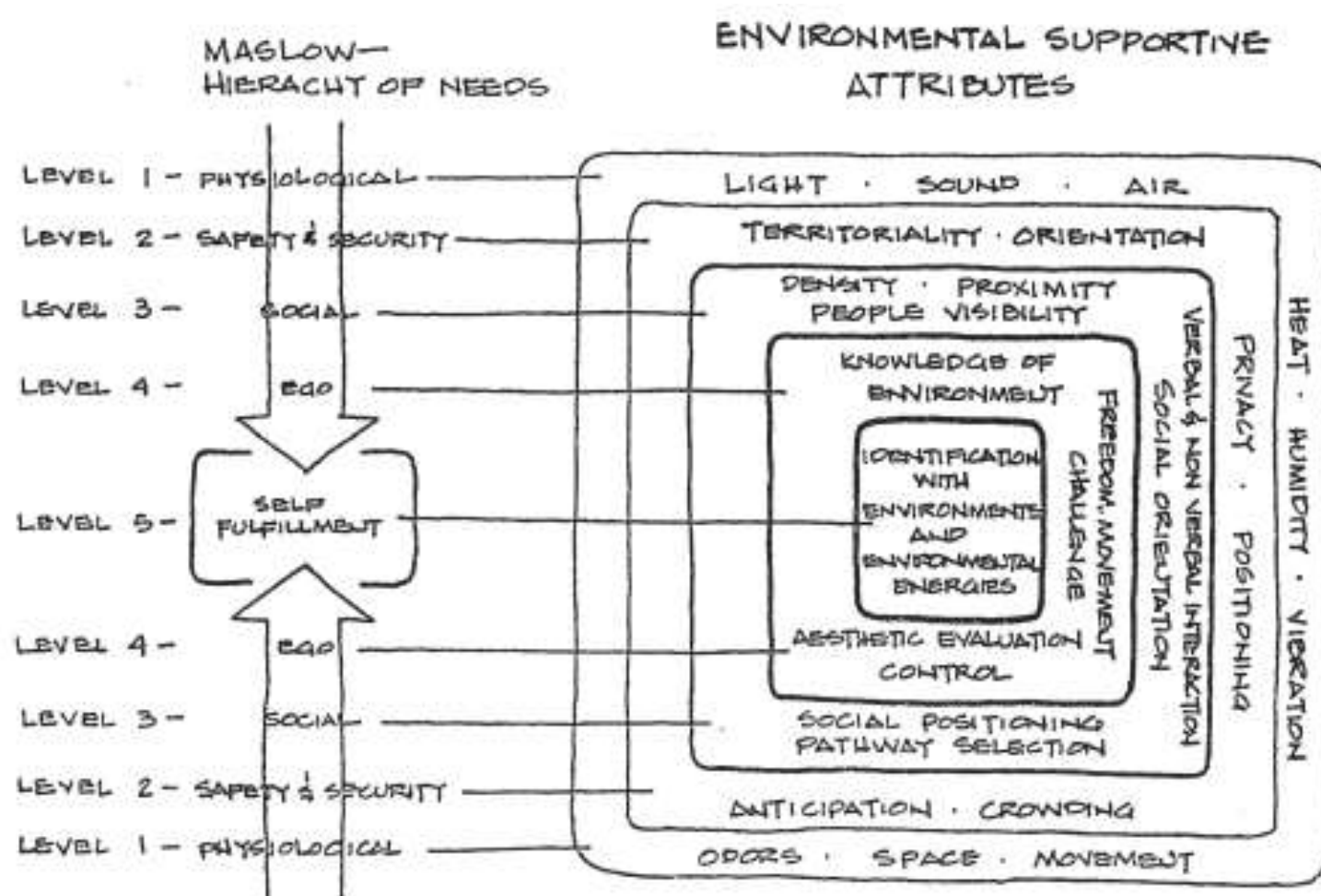
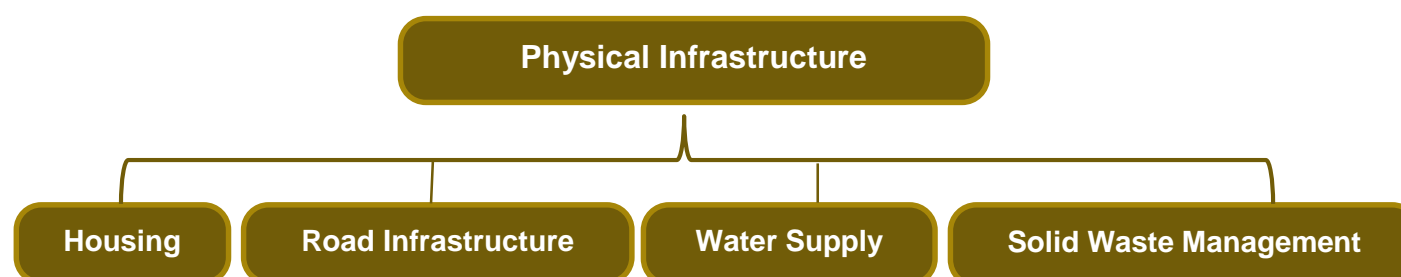


Figure 8-1 Maslow Hierarchy of people Need (Poirier)



Infrastructure is a set of facility and system serving a village, city, country, or any other area. It also includes all the services required for the economy of the place to function. Infrastructure is considered as the basic systems that undergird the structure of economy. (O'Sullivan & Sheffrin, 2003). It is primarily composed of public and private infrastructures such as roads, bridges, water supply, waste management, housing, and telecommunication.

The Uppunda Gram Panchayat has been provided with all the necessary amenities and infrastructure such as Anganwadis, Primary and Higher primary Schools, Health care centre, Co-operative Society, Banks, Post office, Worship areas, Commercial Shops, Housing, Road Infrastructure, Water Supply and Waste Management (Panchayat-Uppunda, 2020).



The Panchayat has succeeded in providing its people with basic required infrastructure to sustain everyday life and work. But infrastructure is one such element which is growing everyday and there are different methods and technologies that help develop the infrastructure in a more efficient and sustainable manner such that both the end users and the providers are benefitted. When considering the overall infrastructure provided in the Panchayat at present four major infrastructure stand out, The Housing facility, Road infrastructure, Water supply and Waste management. While the panchayat has seen to it that the housing facility and water facility has reached a maximum number of people, the road infrastructure and waste management needs to be further developed such that it can be better utilized by the people in the Panchayat.

8.1. Housing

The concept of ideal community environment is the most contemporary in recent days for any rural upbringings. A brief concept and advantages of a neighbourhood-based solution are offered by the organic nature of those spaces, whether the rural environment is completely functional or not as it the space is largely sensitive to local factors.

The housing in Uppunda is a fair mix of both Government provided houses and ancestral homes that are about 100 years old (Figure 8.2 (a)). Some of the families have continued living in their ancestral homes and are independent from any of the aid provided by the panchayat in regard with Housing. While some of the other families have been provided with 5 cents government land (Figure 8.2 (c)) along with a certain financial aid to construct the residence. Most of the housing units are restricted only to ground floor level (Figure 8.2 (b)), while only a small percentage of houses go beyond the ground floor level. The most common type of construction material used by the people was Stone, Mortar and Mud along with Mangalore tiles for roofing.



Figure 8-2 Housing Typology (a), 100 years old Ancestral house, (b) Ground floor level house, (c) Constructed on Govt. given 5 cents land (MSAP, 2020)

8.2. Identification of Issues

As per survey, it was found that approximately 40% of the houses are pucca, whereas around 60% of the houses fall under the category of semi-pucca to kuccha (Figure 8. 3). During the survey most of the houses fall under the category of good and livable condition which accounted for almost 70% of the settlements (Figure 8.4).

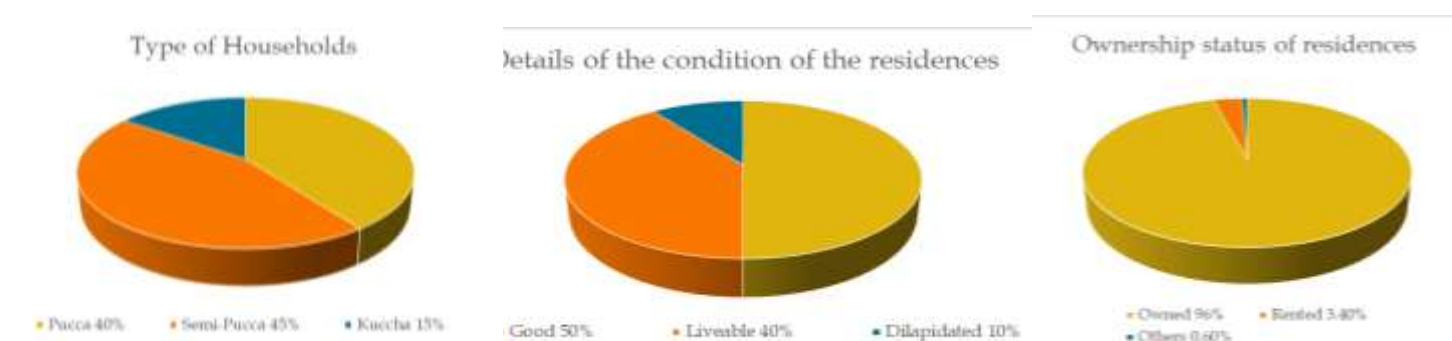


Figure 8-4 Percentage of residences based on their construction type (MSAP, 2020)

Figure 8-5 Percentage of residences of the basis of their existing conditions (MSAP, 2020)

Figure 8-3 Percentage of residences of the basis of their existing conditions (MSAP, 2020)

Although 30% of them were to be found in a dilapidated state owing to the existing financial conditions of the residents who are unable to gather enough funds to renovate their houses.

Most of the houses have been built in the last 10 decades within which less than 10% were constructed in the last 10 years. Only about 30% houses are more than 50 years old. Mostly 96% the land and houses belong to owners and about 3.04% is coming under rented ownership (Figure 8.5).

Table 8-1 Observation of Uppunda Housing Conditions (MSAP, 2020)

Settlement Pattern	Age of Building (years)	Ward No.	Type of Household	Condition of Household	Observations	Images (Sorce: MSAP Team)
Along the coast	0-30	6, 7, 8, 10	Semi Pucca - Kuccha	Liveable - Dilapidated	Few houses were very poor in condition. Plinths are of a very less height. Almost all houses have their toilets outside (some a little far off from the main structure), except a few that were rebuilt recently. Houses just built randomly, therefore no proper road networking. Few aren't able to procure loans from banks for house renovation.	
	30-50	6, 7, 8, 10				
	50-70	8, 10				
	70-100	8, 10				
In between coastal & NH wards	0-30	1, 2, 3	Semi Pucca - Kuccha	Good - Liveable	Every household has a well but rarely any house has municipal supply. No waste disposal or collection facility, waste is burnt. Most want to construct new houses but people cannot afford to do so due to issues regarding procurement of loans for renovation.	
	30-50	2, 3				
	50-70	2				
	70-100	2				
Along the NH	0-30	4, 5, 9	Pucca - Semi Pucca	Good	The houses within the area are scattered and lacks planning. No means of waste collection, in the panchayat, residents either burn the waste on their own or dump in the nearby empty plots. There were complaints water stagnation in the streets of few houses during the monsoon days.	
	30-50	4, 5, 9				
	50-70	4, 5, 9				
	70-100	4, 5				

The village is seen to be dominated mostly by low height buildings with a small percentage of buildings which are seen to go beyond the ground floor height. Also, not all are attached with the main building block, most of the houses are seen with having access to toilets made either under certain schemes or by the willingness of the owner (Table 8.1). There were various issues to be found regarding basic amenities and facilities at the household level:

1. Waste management system

The major issue prevalent in all wards is the lack of a waste management system. Not only is there is an issue of waste being dumped on open/vacant plots, but there is no system of waste collection either from the Municipal Corporation side. This leads to further issues of people burning waste, which in turn might lead to added problems of air pollution as well as poses as a fire safety hazard.

2. Unplanned developments

Expect a few areas with some wards (wards 2 & 9), the houses present are scattered in a haphazardly manner, lacking a proper layout of planning. This poses as an issue as the interior roads which lack basic infrastructure, are not in the best condition to connect all the houses nor link them with a proper drainage system.

3. Location of toilet blocks

Some ward houses have their toilet blocks detached from the main structure. This might cause issues during heavy rainfall time as it might be difficult for the house residents to reach these blocks, especially the ones built even further away from the main building.

4. Condition of houses

The houses particularly the ones situated near to the coast (wards 6 & 7) are not seen to be in the best of conditions. Few who wish to re-build their houses, lack the means or money required to do so. The main construction material seen is laterite and mortar for walls, bamboo as rafters and Mangalore tiles for the roof.

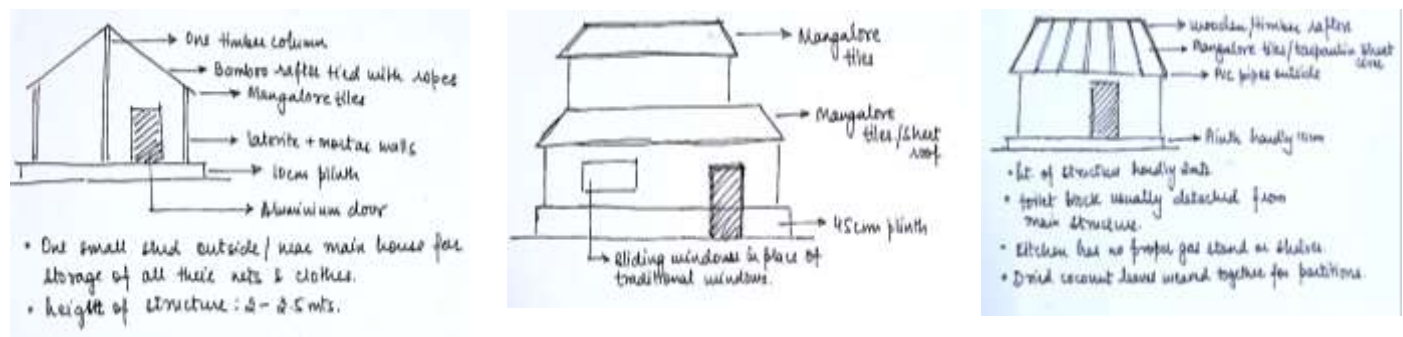


Figure 8-6 Example of Typical layout of Uppunda Houses

5. Low plinth heights



The plinth provided in some houses, is observed to be low, which causes the problem of water entering inside households during the rainy season. Moreover, the materials used for building the plinths are found to not be water resistant, causing issues during heavy rainfall.

6. Safety & Security

Few wards (particularly ward 2) have witnessed the issue robbers in the vicinity, posing a threat to the safety and security of the neighbourhood. As a result, due to fear, people are hesitant to help out each other. Hence, we see a lack of community involvement or development at neighbourhood level.

7. Water supply

Water is also one major issue within some households in certain wards. Wells seem to be the main source of water, but during the dry season when there is a shortage of water, there seems to be no alternate source of water supply. Some houses only get water supply on alternate days.

8. Storm-water drainage

Most of the interior roads are kuccha, constructed out of mud, and hence get flooded with water during rain which makes it difficult to access them. The lack of a proper storm water drainage system in place aggravates this issue further.

9. Unkept drains

The already designed storm water drains have been left untreated, and has created lot of blockages & stagnation issues, leading to growth of various insects, posing as a health hazard.

10. Power supply

Lack of proper electricity supply in certain wards is also a problem. Frequent power cuts are witnessed during rainy seasons, and the provision of mobile network also seem to lack regularity.

11. Alternate energy sources

Use of an alternate source of energy, such as using solar power or harvesting rainwater, is not thought of or implemented, and can only be seen in a handful of houses across a few wards.

8.3. Existing guidelines regarding Built Form

8.3.1. CRZ Guidelines

According to Coastal Regulation Zone (CRZ) in Udupi district, following points have been formulated regarding planning, designing or construction of built forms in the area (Shetty, 2012).

- Uppunda is high-density, low risk zone with 200 dwellings/km². But in the CRZ area there are 498 dwelling units/km², hence in the CRZ area scope for further construction is not available.
- In low risk zones, the maximum density possible is 350 units (1575 persons)/km² @ 100m²/unit. Assuming 65% of area goes for residences and other for institutional facilities, roads and infrastructure facilities, the FAR at unit level is 0.05 and maximum ground coverage of 5% on the condition that there is an access road of 4m wide and drainage on one side of the plot.
- Amongst 17 important biospheres listed by the UNESCO, the Tallur Biosphere near Gangolli (Kundapur taluk) is the real repository of biodiversity. Such an area needs to be considered specifically as 'No Development Zone', protected from any kind of man-made destruction, directly or indirectly.
- As per norms for regulations of activities under the CRZ, in CRZ-I, no new construction shall be permitted, which includes new residential homes, temporary settlements, permanent structures, recreational facilities, public infrastructure such as roads, bridges, schools, playgrounds, parks, medical facilities, shops, etc. Only the reconstruction of these structures, if they are existing authorized constructions, would be possible.
- The structures in CRZ-I areas (except in high risk zones & environmental sensitive areas) & CRZ-II areas could be allowed to be repaired without the increase in number and built up area of the structures. Also, since the density in most of these areas is high, it is necessary that they be of light weight and eco-friendly material so that they because least harm to the delicate environment.
- Buildings can be constructed only on the landward side of an existing road in CRZ-II areas not on the seaward side of existing roads.

- Renovation and repair of existing buildings shall be permitted only using light weight construction technique with eco-friendly materials & sustainable technology.
- In CRZ-III areas up to 200mts from the High Tide Line (HTL) have to be earmarked as a 'No Development Zone' (NDZ). Only agriculture, horticulture, gardens, pastures, parks and play fields are permitted.
- Vacant plots between 200-500mts of the HTL in designated areas of the CRZ-III can be developed with prior approval from the Ministry of Environment & Forest (MoEF).
- Building permissions for construction or re-construction will be subject to the conditions that the total number of dwelling units shall not be more than twice the number of existing units.
- The total covered area on all floors shall not exceed 33% of the plot size.
- The overall height of the construction shall not exceed 9mts.
- The construction shall not be more than 2 floors (G+1).

8.3.2. Policies Related to Housing.

1. **Pradhan Mantri Awaas Yojana- Gramin (PMAYG)** : The Ministry of Rural Development aims to tackle issues related to rural housing by providing 'Housing for all' under the *Pradhan Mantri Awaas Yojana-Gramin (PMAYG)* (Gol, n.d.). PMAYG, earlier known as Indira Awaas Yojana (IAY), is a scheme for rural housing by the Indian Government. This social welfare program was initiated to meet the objectives of the "Housing for All" scheme by the year 2022.

Aim of PMAYG: To provide a 25-square meter pucca house including basic amenities to beneficiaries of the scheme. The houses provided will have certain special features such as it would be disaster-resilient, low cost, and will be built keeping in mind the socio-cultural and geo-climatic factors. (Raj, Guidelines for Preparation of Gram Panchayat Development Plan, 2018).

2. **Development and Panchayats Department, Haryana, 2018** (Haryana, 2018):

- Housing for all
- All eligible habitations connected by all-weather roads
- All deprived households as members of SHGs with bank linkage
- Solid and liquid Waste Management
- Wage employment and community as well as individual durable assets under MGNREGA (Mahatma Gandhi National Rural Employment Guarantee Act)
- Mission Water Conservation under MGNREGA
- Pension for old, widow and disabled
- Placement based and self-employment skills for all eligible youths
- Village roads with MGNREGA

The core aims of the State/ UTs is to provide the beneficiary a bouquet of options of house designs according to local conditions, using appropriate technologies suitable to the region of the residences. The core house design should include (Haryana, 2018):

- Dedicated space for hygienic cooking
- Toilet and bathing area.
- Adequate space for pursuing livelihood activities.
- Rain water harvesting system
- A verandah

8.4. Road Infrastructure

Connectivity is essential for any village as it provides accessibility to services and important amenities within the village and to neighbouring villages as well. Uppunda's unique coastal location has allowed it to have access through the coastal road and the NH66.



The map shows the existing roads in the village (Figure 8.7). The NH66 passes through ward numbers: 1, 2 and 3 towards the east. The coastal road runs parallel to the coast towards the west, running through ward numbers: 6, 7, 8 and 10. The village has four east-west roads passing through all wards. These are the pucca roads and material used



Figure 8-7 Road Network (a). Approach Road towards NH66, (b). Concrete Road, Bijoor, (c). Concrete Road, Bijoor (MSAP, 2020)

for these roads is bitumen and concrete. Although all other remaining roads are kuccha roads, and some walking pathways pass through the fields which have been created by people walking on foot to reach to their houses. This shows that not all the hamlets/houses have access to the main roads.

Public transport is available, but villagers must walk 1.5km to get it. The present Arterial Roads are Kuccha about 3m to 4m in width and are in poor condition and have not been maintained. They lack shoulder and storm water drain on either side, thus making the roads prone to flooding during heavy rains and thus disrupting the daily commute of the residents. There is a fair mix of both tar and concrete roads within the panchayat.

From onsite observations it was found that the built-up is dense towards the coast, the highway, and the elevated part of the midland, low-lying region the settlement is sparse as shown in Figure 8.9.



Figure 8-8 Map Showing Google earth map and GIS Generated Road Map for Uppunda Village (www.nrsc.gov.in, n.d.)

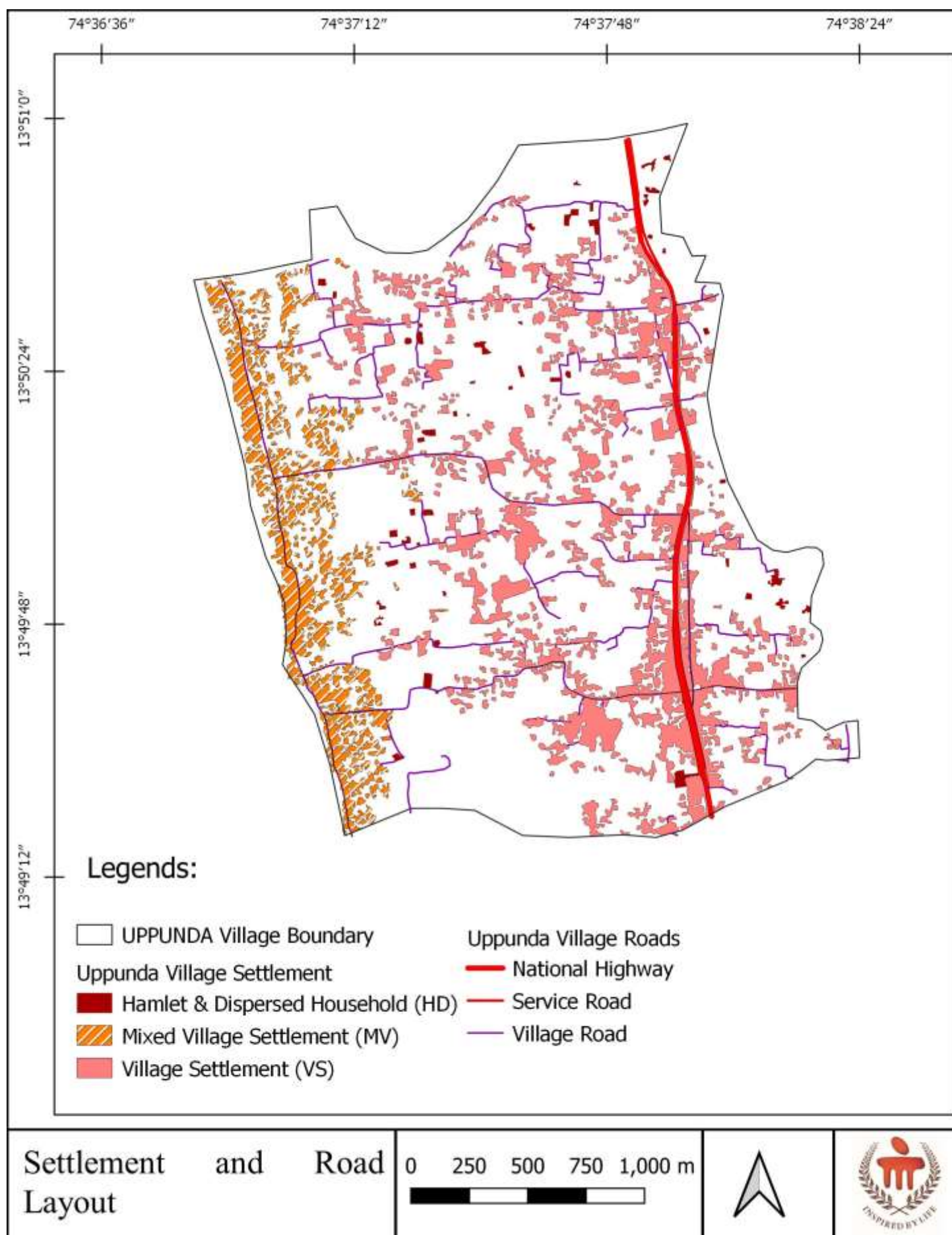


Figure 8-9 Settlement and Road Layout of Uppunda GP

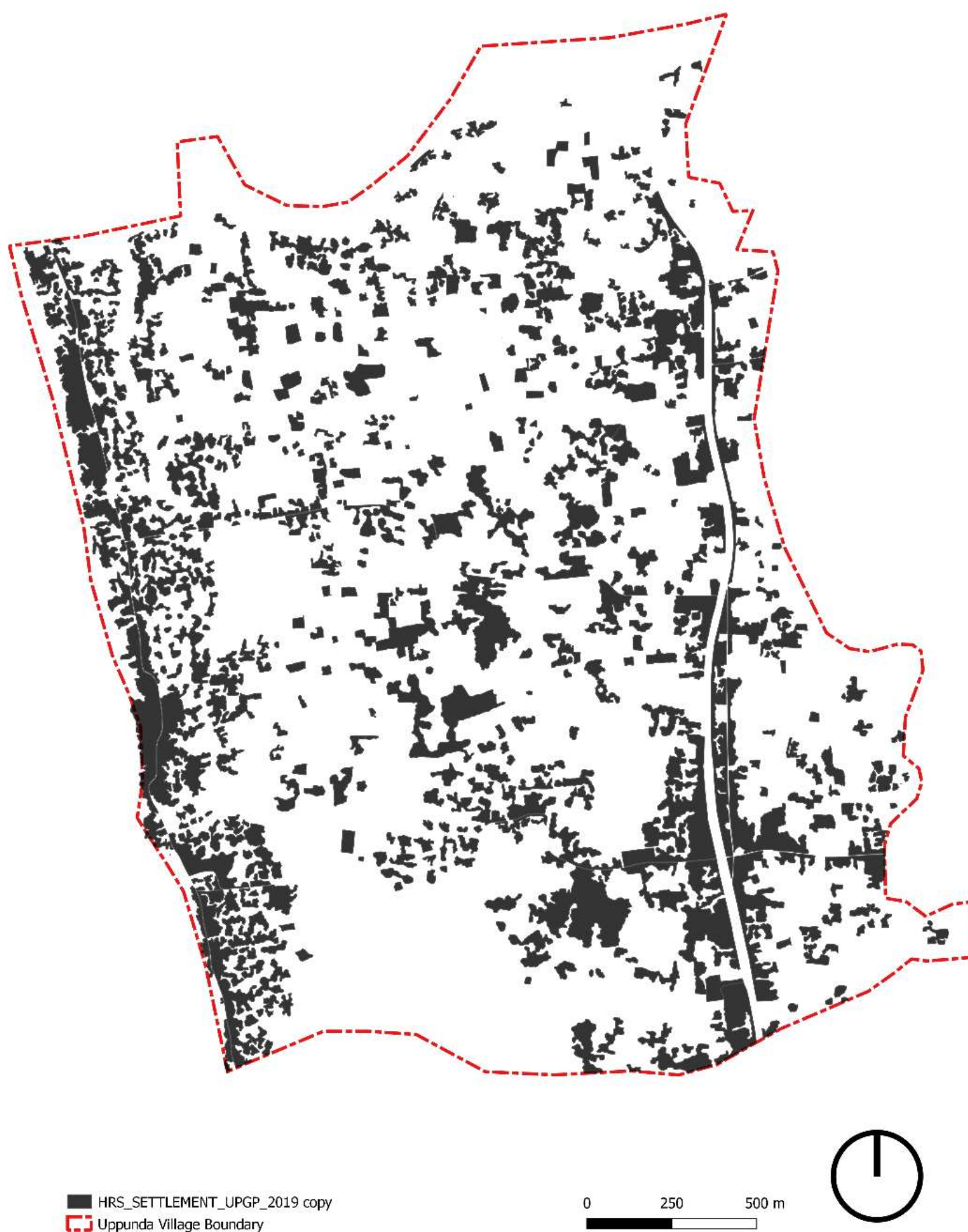


Figure 8-10 Map showing Figure Ground of Uppunda Village (www.nrsc.gov.in)

The map below, (Figure 7.10), displays the existing road hierarchy in the village and the images below show the issues in the village with respect to road infrastructure. The roads do not follow the natural course of the slope. Except for the main roads, all the other arterial roads are kuccha roads. Not all roads connect to all houses in the wards as mentioned earlier. The roads lack storm water drains facility and coupled with mud roads causes localized flooding of roads and commute gets hampered. During rains, the arterial roads become muddy which hampers the commute.

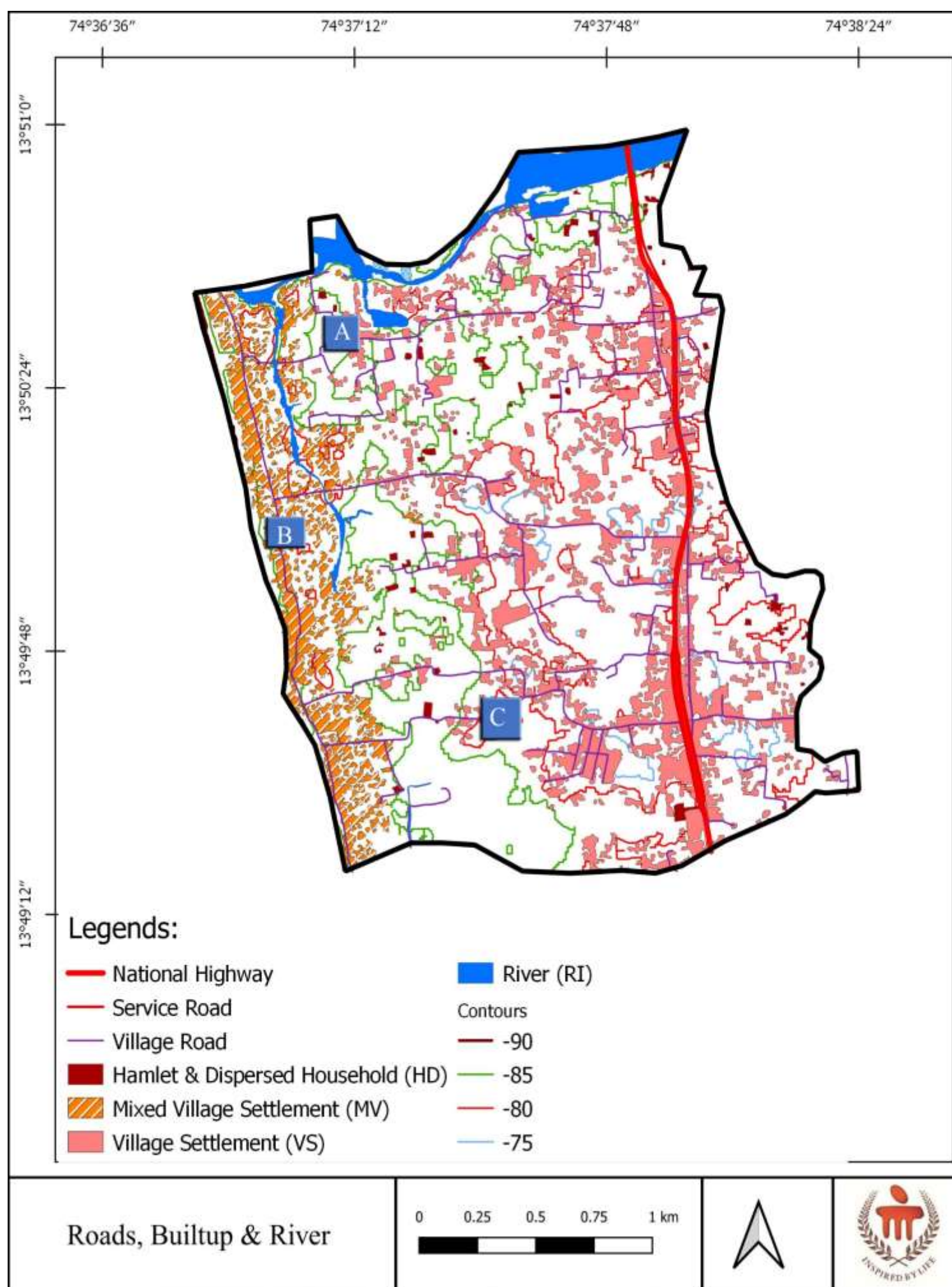


Figure 8-11 Map Showing Hierarchy of Existing Roads in Uppunda Village



Sketches: Illustrating current issues on site with photographic evidence.



Figure 8-12 (a) Coastal Road,

(b) Narrow road with 3-4 mt wide,

(c) Inadequate Drains

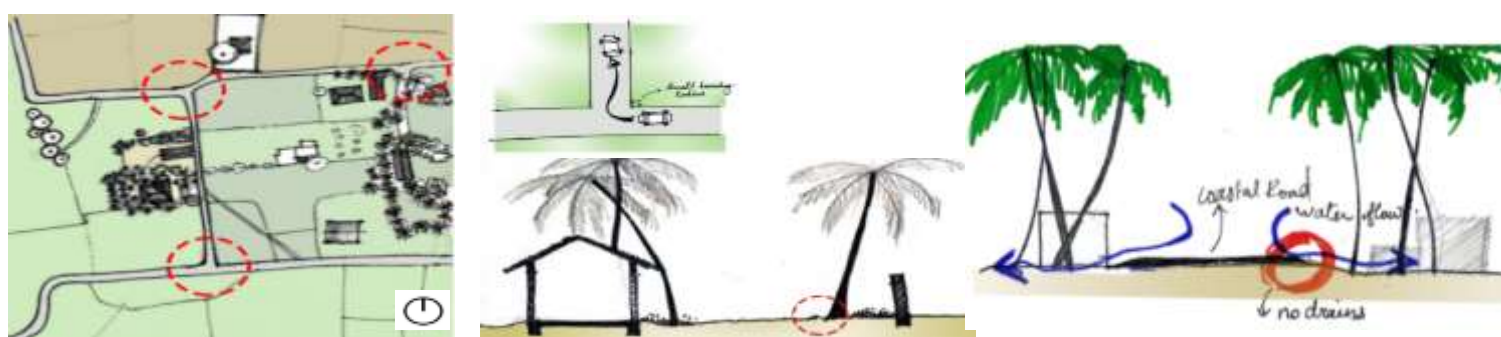


Figure 8-14 Detail at A on Key plan on Figure 8.11 (Inadequate turning radius issues and mud roads with no drainage for storm water, narrow roads)

Figure 8-13 Detail at B on key plan

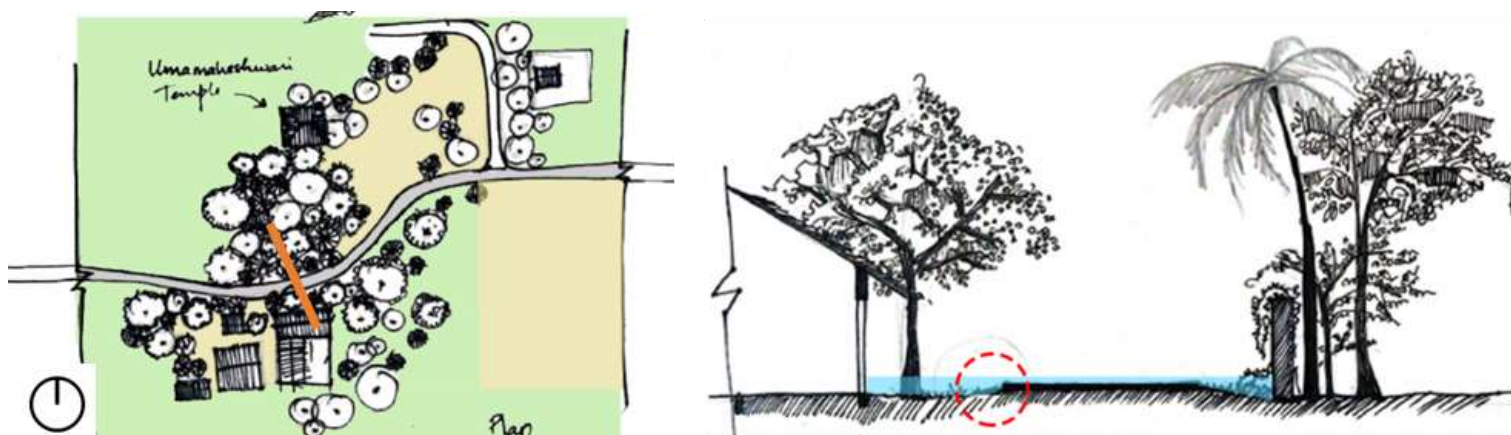


Figure 8-15 Detail at c on key plan Figure 8.11 The roads lack storm water drains facility, due to this there would be chances of flooding, no streetlights present, arterial roads become muddy which hampers the commute, The road shoulders are not well defined one

8.5. Existing Guidelines and policies for Rural Road Development

8.5.1. Pradhan Mantri Gram Sadak Yojana (PMGSY)

Introduction:

Rural Road Connectivity, and its sustained availability, is a key component of Rural Development as it assures continuing access to economic and social services and thereby generates a sustained increase in agricultural incomes and productive employment opportunities. It is also, as a result, a vital ingredient in ensuring sustainable poverty reduction which demands permanent rural connectivity, encompassing a high level of quality of construction followed by continuous postconstruction maintenance of the road asset and in fact of the entire network. Rural roads influence the process of growth by facilitating the dispersal of knowledge and reduction of inequalities. They act as infrastructure multiplier and poverty reducer. (PMGSY, October 2019).

Objectives of PMGSY:

The PMGSY was launched on 25th December 2000 to provide all-weather road access to unconnected habitations with population:

- i. Up to 500 in Plain Area
- ii. Up to and More than 250 in the Special Category States and Desert Areas
- iii. 88 selected Backward Districts

8.5.2. National Rural Roads Development Agency (NRRDA)

National Rural Roads Development Agency was registered as a society on 14th January, 2002) with the basic objective of extending technical and management support to the Government of India in implementation of Pradhan Mantri Gram Sadak Yojana (PMGSY). It got its new name NRIDA in May 2017 after inclusion of rural housing activities in its scope of activities. (<https://pmgsy.nic.in/>). National Rural Roads Development Agency (NRRDA) solicits services of consultants for carrying out procurement audit of works tendered/awarded for implementation of PMGSY during the year 2008-09. For the sake of administrative convenience, NRRDA has grouped the States under four separate packages as under:

- Group-1 covers Assam, Arunachal Pradesh, Orissa, Tripura;
- Group-2 covers Gujarat, Madhya Pradesh, Maharashtra;
- Group-3 covers Jammu & Kashmir and Uttar Pradesh; and
- Group-4 covers Andhra Pradesh, Chhattisgarh & Karnataka.

Once the Core Network is prepared and pavement condition survey conducted, it is possible to estimate the length of roads for New Connectivity as well as Upgradation for every District. States may, each year, distribute the State's Allocation among the Districts giving at least 80% on the basis of road length required for providing connectivity to Unconnected Habitations and upto 20% on the basis of road length requiring Upgradation under the PMGSY. The District-wise allocation of funds would also be communicated to the NRRDA and STAs every year by the State Government.

8.5.3. Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)

Introduction:

Mahatma Gandhi National Rural Employment Guarantee Act or MGNREGA, is an Indian labour law and social security measure that aims to guarantee the 'right to work'. This act was passed in September 2005 under the UPA government of Prime Minister Dr. Manmohan Singh.

It aims to enhance livelihood security in rural areas by providing at least 100 days of wage employment in a financial year to every household whose adult members volunteer to do unskilled manual work. (Ministry of Rural Development, 2005).

Objectives of MGNREGA (Source: Dishant James, 2017):

- Augmenting wage employment
- Strengthening natural resources management through works that address causes of chronic poverty like drought, deforestation and soil erosion and so encourage sustainable development
- Strengthening grassroots processes of democracy
- Infusing transparency and accountability in governance
- Strengthening decentralization and deepening process of democracy by giving a pivotal role to the Panchayati Raj Institutions in planning, monitoring and implementation

8.6. Water Management

India has more than 18 % of the world's population, but has only 4% of world's renewable water resources and 2.4% of world's land area. (Ministry of Water Resources) The availability of water is limited but the demand of water is increasing rapidly due to growing population, rapid urbanization, rapid industrialization and economic development. Therefore, availability of water for utilization needs to be enhanced to meet the increasing demands of water. Direct use of rainfall, desalination and new additional strategies for increasing the utilizable water resources should be emphasized.



In the last few decades, Karnataka has seen an intensification in the impacts of climate change, land use modifications and urbanization on the hydrology of river basins, as also the finalization of inter-state tribunal awards on multiple river basins. (KJA, 2019) All these developments have substantially complicated and aggravated the water challenges in Karnataka. In view of this crisis, in December 2017, the Karnataka Jnana Aayoga (KJA) set up a Task Group to draft a new water policy for the state, which would reflect holistic view of water in all its dimensions and tries to address the multiple concerns of the people of Karnataka vis-à-vis water. In the case of Udupi District, the main drainage is westwards. As the Western Ghats are located on the eastern part of the district, the rivers and streams of this district necessarily flow from east to west. Varahi, Gangolli, Sitandi and the Swarna are the important rivers. In the monsoon season all the rivers and streams become swollen due to heavy rains and some of them overflow their banks, inundating the surrounding areas. Multi-village drinking water supply scheme, Karnataka Integrated Urban Water Management Investment Program aim to design, build, operate and transfer (DBOT) of a fully automated water scheme for supplying drinking water to over 130 villages in a timely and cost-effective manner. (MULTI-VILLAGE DRINKING WATER SUPPLY SCHEME – GADAG DISTRICT)

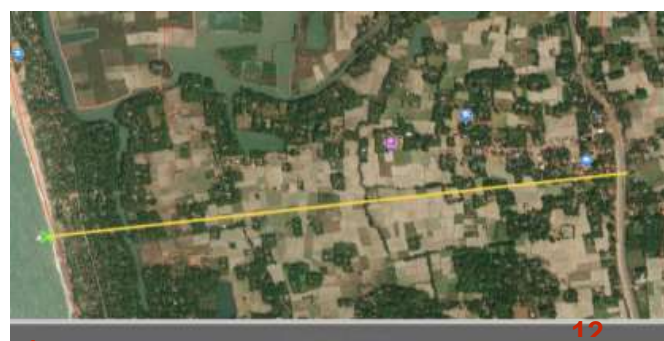


Figure 8-16 : Schematic Section of ward 10, 9, 1, Source Google Earth

8.6.1. Identification of Issues

Water use efficiency in Indian command areas is among the lowest in the world. Karnataka (and several other states) are lagging far behind global standards in this regard. (KJA, 2019) Lack of water during the summer season restricting to grow rice crops only once a year. So residents depends on natural rain for irrigation and harvesting.

Majority of agricultural activities are rainfed as it majorly depends on rain cycle. Paddy which is majorly grown in the GP needs a lot of water for irrigation which is not available during non rainy season. Hence it cannot be grown post rainy season due to less availability of water for agriculture. Lack of water storage practice is seen in the GP as there are only ponds as a catchment and no other man-made structures to hold the runoff water. This further impacts in agricultural practices during non-rainy season.

As Uppunda receives around 4000mm of rainfall, due to bowl like section profile of the GP, Stagnation of water is seen in wards 4,5, 9. (Refer Figure 8.16). This is mainly due to the lack of drainage to carry out the

water to the nearby natural body. Houses on wards 4,5 and 9 are most affected as these lies in the low-lying area of the village. The schematic section in figure 8.16 is shown with a highlighted box depicting the low laying area. People have domestic water scarcity issue as the well water is salty and cannot be used for consumption as coastal salinity intrusion is also resulting from depletion of coastal groundwater. Nitrate and pesticide contamination are two other threats that originate from the overuse of fertilizers and pesticides in agriculture. Canals present along Ward 8 and 10 gets flooded during rainy season due to non-maintenance of the canal wall. This leads to collapse of canal wall and intrusion of sea water.

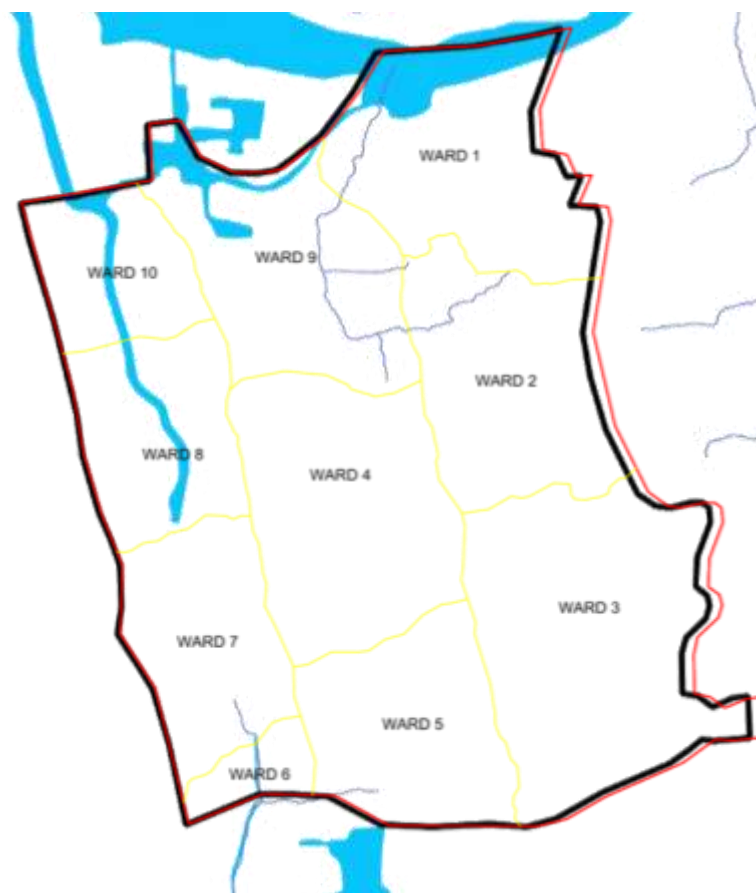


Figure 8-17 Ward Map with Natural Drainage,

8.6.2. Existing guidelines regarding Built Forms

8.6.2.1. Multi-Village Drinking Water Supply Scheme – Gadag District, Karnataka, India

The Rural Water Supply & Sanitation Department, Karnataka (RWSSD Karnataka) is responsible for supplying drinking water to over 130 villages in a timely and cost-effective manner. Under this scheme, it involves the design, build, operate and transfer (DBOT) of a fully automated water scheme. Water is pumped from an intake station at the Renuka Sagar reservoir to a water treatment plant (WTP) with a capacity of 26 ML/day. Treated water is transferred through various pumping stations and several types of balancing reservoirs, creating a reliable and cost-effective gravity-based distribution network. Drinking water is delivered to the highest tank in each of the 131 villages in the Nargund and Ron “talukas” (administrative districts) within the Gadag District of the Karnataka state. Remote automatic meter reading (AMR), pressure management and water-quality monitoring systems were applied at consumer connections and at various locations along the conveyance system.

The benefits of this scheme is that it increases the availability of drinking water for the village resident which is major issue in the case Uppunda. With the help of this scheme, water quality will be improved with treatment and remote monitoring. Also, it will help in reducing loss of water due to modernized water supply. Hence, this similar scheme can also be applied in Uppunda GP for a better sustainability.

8.6.2.2. Karnataka Rural Water Supply Project (KRWSP)

Under Rural Drinking Water and Sanitation Department, Government of Karnataka, a project is in process to provide reliable, sustainable and safe drinking water supply to the rural communities and selected urban local bodies in Mandya and Vijayapura districts. In this, the project features two broad components.

Component 1 - Investment in infrastructure for multi-village bulk water supply systems:

1. construction of bulk water supply structures including: intake structures, pumping stations, rising mains, water treatment plants, etc.
2. development of supervisory control and data acquisition systems (SCADA) for water supply system management.
3. Implementation support by Project Management Consultants (PMCs), and operation and maintenance after construction for next 5 years.

Component 2 - Community development and institutional strengthening:

1. support to community participation and engagement in the project and village water supply distribution.
2. assessment of the baseline water distribution and household connection situation in the project area
3. technical assistance in developing institutional capacity for bulk water supply O&M and cost recovery, and piloting the study result in the project districts.
4. support in monitoring and evaluation (M&E) of the project activities, outputs and outcomes.



8.6.2.3. Bhungroo- Ground Water Injection Well

It is a water management system that injects and stores excess rainfall water underground. This water is then used for irrigation during summers. The intervention was carried out in sites identified by the Gram Panchayat of Gujrat. In this, one unit with sub-surface storage at three levels between 25 to 110 feet with a total capacity of 2 crore litres was implemented. The farmers were trained in installation of Bhungroos. Installation of piezometer was done for water level monitoring on a day-to-day basis. This enables the communities to continue farming for more than half of the year. The non-saline rainwater when mixed with the underground saline water brings down the salinity of the groundwater, making it fit for agricultural use. The system also enables one to lift up and use the stored water during dry spells.

The Bhungroo

The technology is open source so that it is scalable in other places. Bhungroo does have a non-negotiable principle, however—that the technology should be used by poor people only.

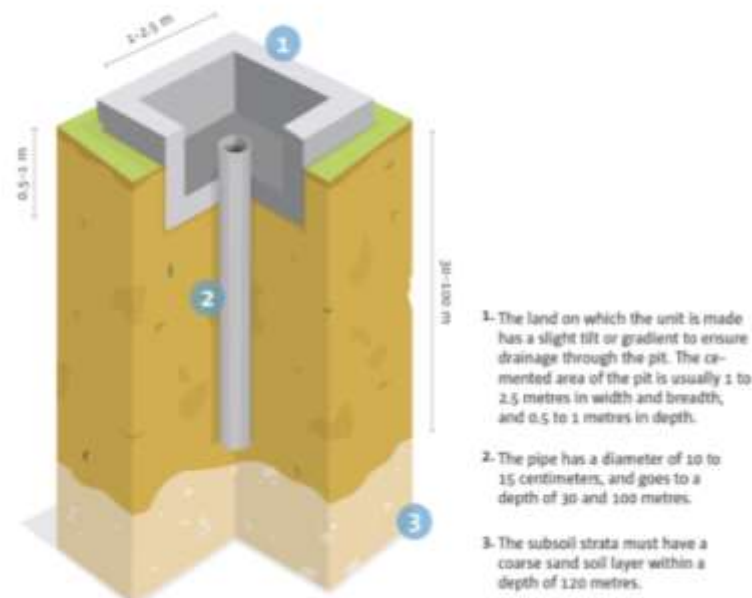


Figure 8-18 Schematic Diagram (Source: <http://www.naireetaservices.com/>)

With the help of this technique, the issue of paddy cultivation during non rainy season can be tackled in the Uppunda GP.

8.6.3. Adaptive Water Management in Chinchojhar village, Valsad, Gujarat

This was implemented by Swajaldhara. Under this, a collection tank was built near a perennial spring at a height of 120 meters from the main village. A storage tank was built 40 meters above the village and connected with pipelines. The tank capacity was 10000 liters and stand posts were constructed to provide water to the village. This was implemented because entire village had only one open well which use to run dry in summer months. Through this intervention villagers were able to obtain water in their village and they no longer had to depend on one single open well to meet their daily water requirements. Steps were taken up like the storage tank was covered and kept water free from contamination and reduced health risks. The intervention also allowed the villagers to tap into a perennial source thereby ensuring maximum water security.

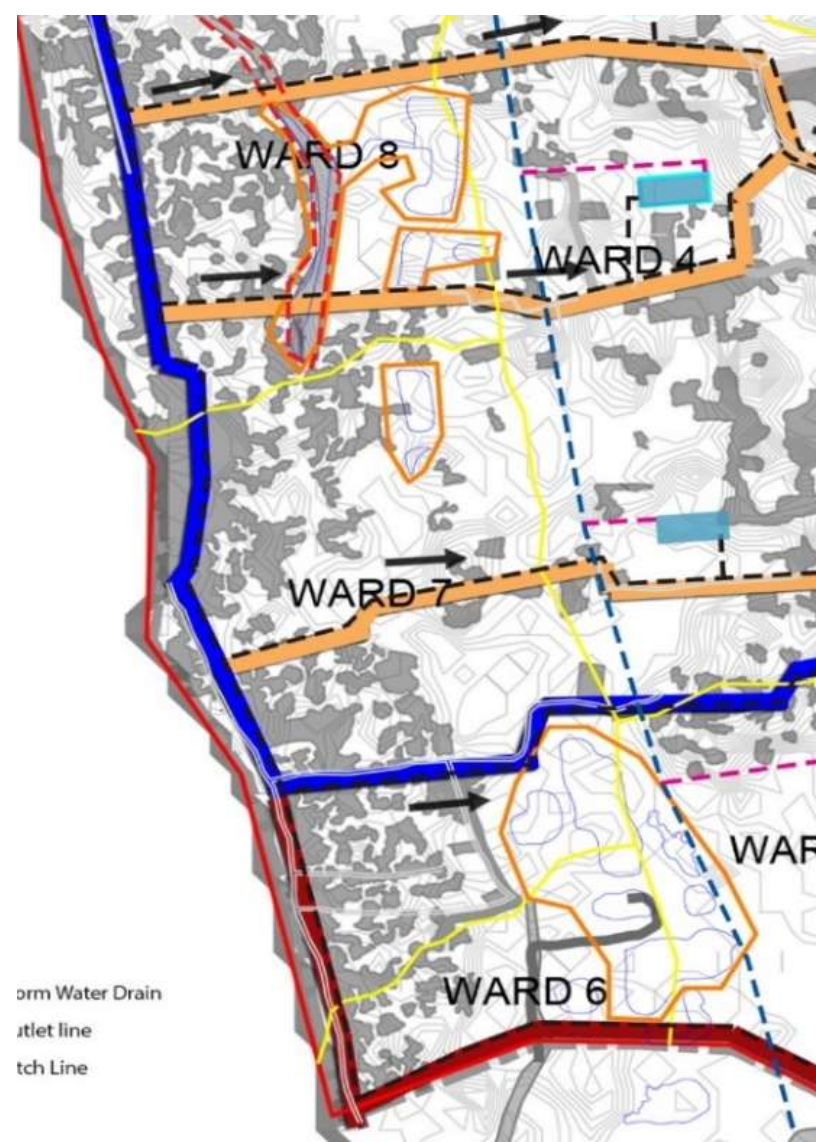


Figure 8-19 Water Bodies in Uppunda,

Similarly, in Uppunda, the small water bodies which are present can also be clubbed in a similar manner to increase the water capacity of these ponds (Figure 8.19).

8.7. Solid Waste Management

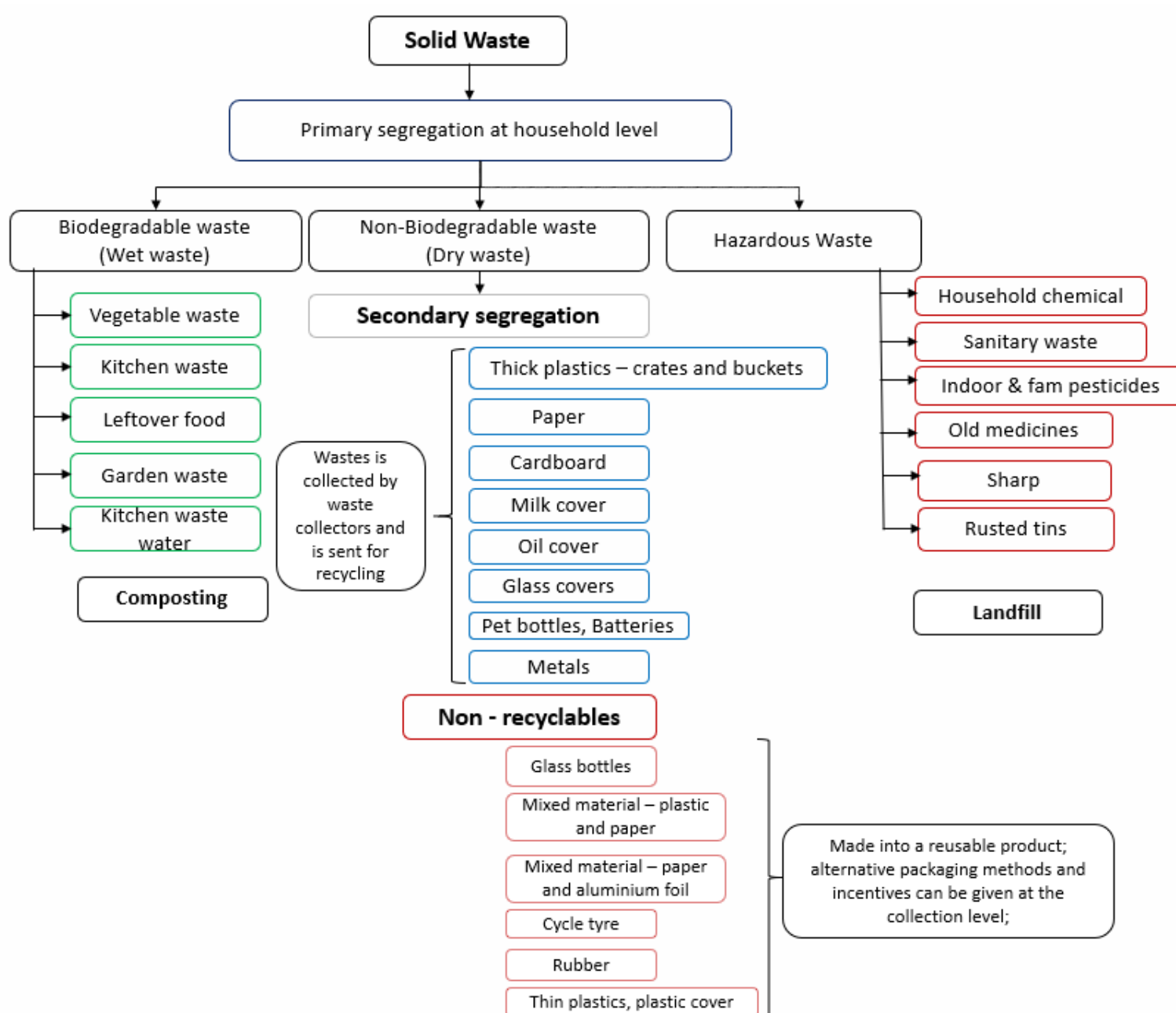


Figure 8-20 Flow chart representing the waste at the village – Uppunda (MSAP, 2020)

The village of Uppunda that is spread on an area of 530.6 hectares (*District Census Handbook, Udupi, 2011*) (593.8 hectares – GIS measured), with a population of 11,456 residing at 2,167 dwelling units (*District Census Handbook, Udupi, 2011*). Every household generates waste in accordance with their routine activity not only in terms of their household basis but also with respect to their occupation, fishing, and agriculture. The residents either dump the waste into nearby empty plots or burn the waste at their own backyards (Figure 8-20). The Storm water drain provided in some of the Arterial roads have not been maintained, which has caused in blockage of the drains resulting in foul smelling and an unhygienic surrounding environment. In the village, there is no proper waste management technique that is followed, there should be a precast of a proper holistic system that has to be implemented in the village to manage the waste that is generated by the households and other activities. Solid waste can be classified in terms of biodegradable waste, non-biodegradable waste, and hazardous waste (*Solid Waste Management in Rural Areas A Step-by-Step Guide for Gram Panchayats, 2016*).



Figure 8-21 Waste Disposal at Uppunda Gram panchayat (a).Blocked Drainage, (b). Composting, (c). Waste burnt in household backyards (MSAP, 2020)

In general, the dry waste includes plastic covers, sachets, empty containers, milk cover, used tooth brush, wrappers, materials used for packaging the eatables, water bottles, tetra packets, newspapers, cosmetic



containers, cardboards, used and unused stationaries like pencil pen, metal tins, cans, waste cloth material, paper napkins, rubber, tyre, leather etc., that are utilized in every household, the materialistic solid waste (*Solid Waste Management in Rural Areas A Step-by-Step Guide for Gram Panchayats, 2016*).

As mentioned above, wet waste includes vegetable peels, fruit peels, leftover foods, rotten eatables, used tea bags, egg shells, coconut shell, that is, all the kitchen waste, garden waste, agricultural waste etc., which are seen at the household level in the village. These are biodegradable waste and ones these wastes are recycled it can be utilized again for other purposes. In few of the wards in Uppunda to manage these biodegradable waste method of composting is followed; when the kitchen wastes are buried underground, it breaks down and acts as manure to the soil, this increases the nutritive value of the soil. This in a loop helps the plant to nurture in the vegetable garden and soil in any agricultural setup, as manure to the soil (*Solid Waste Management in Rural Areas A Step-by-Step Guide for Gram Panchayats, 2016*).

According to the survey, in the figure 8-21 the flow chart is structured considering the waste generated in Uppunda. It corresponds to the existing scenario; these can be classified to both recyclable and non-recyclable waste which can be harmful for the environment. In the village, the system of recycling the waste did not exist, there is a waste collector who collects waste and sends it to the recycling unit. Even this practice is done for its monetary value, still not efficient as the system of managing, recycling the waste is not regularized or practiced properly. So, the waste material of the village, among which a very few wastes are being recycled; the rest of it is thrown into the empty plots nearby and into the natural water course. The waste taken by the waste collector are thick plastics that is crates and buckets, paper, carton, metal, bottles for Rs.5 are taken for recycling processes.

Table 8-2 The list of recyclable waste collected by the waste collector; and non-recyclable waste that are thrown into the natural water course and backwaters

Recycled Waste – Taken by the waste collector for money (Rs.5 per bottle)	Non recycled waste – Thrown into the natural course of water i.e., the river and backwaters
Only thick plastics (i.e.,) crates, buckets	Plastic cover
Paper	Thin plastics
Carton	Any grade of plastic cover
Metal	Glass bottle
Batteries	Cycle tyres
	Rubber

8.7.1. Identification of Issues

From the survey made by the MSAP team and Uppunda Gram panchayat volunteers, even though when the waste is collected by the waste collector for recycling process, most of the materials like plastic cover, thin plastics, any grade plastic cover, cycle tyres, rubber material are not recycled. The mixed material like paper and plastic together; paper and aluminum foil are neither recycled nor non-biodegradable; for example: biscuit, chocolate, and junk food wrappers etc. All the waste material types are not segregated instead it is put in one heap of mixed waste material. These wastes are thrown into the empty plots nearby or even burnt at the backyards of the household (MSAP, 2020). These household level techniques of incinerating the waste and throwing at empty plots nearby makes the living environment unpleasant, also the waste dumped into the natural course of water hinders the flow and also, is hazardous to the environment, marine ecosystem.

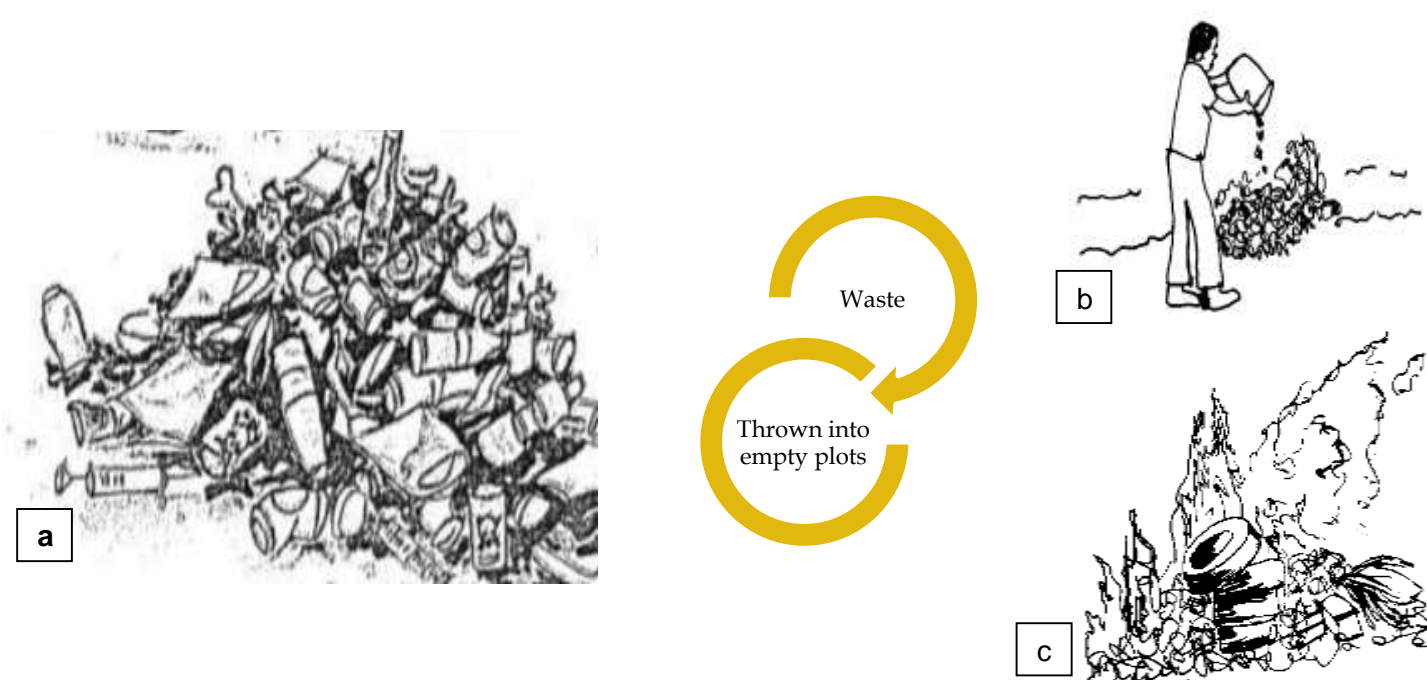


Figure 8-22 Existing condition of Uppunda with Solid waste disposal (a) Heap of waste, Source: (A technical step-by-step-guide of how to start a community-based waste collection service, 2001) (b) Dump yard, Source: Author; (c) Incineration, Source: Author.

As the waste is dumped into the natural course of water hampers the flow of water to drain into the sea it might cause flooding. The dumped waste in the backwaters can be a threat to the aquatic life in the sea. Incinerating or burning the waste, leaves back residue and also releases the harmful carbon monoxide gas into the atmosphere which not only depletes the environment condition by rupturing the ozone (O₃) layer, also pollutes the air which creates an unhealthy environmental condition for the inhabitants to breath and live. From the Table 8.3, it is understood that each ward has issues related to the waste management from the household to the village level. Majorly open dumping, incinerating and no system of collection and segregation is identified at the site during the survey. There are issues of open defecation despite having toilet at the household level. Almost all the houses have toilets built, but the drain network is not equipped orderly, this might cause greywater mix with the ground water, the soil characteristic eventually is another aspect supporting this as they are porous in nature.

The biodegradable waste at the household level can be managed if a proper structure of collecting, composting, segregating happens at the site level in a structured format. The waste that cannot be recycled pose as a threat to the environment. As these wastes are thrown or burnt that are the hazardous not only to the environment but also exploits the health condition of the living population in the upcoming years.

Table 8-3 Issue identification in each ward for waste management collection

Ward No.	Household count/ ward	Issue regarding the waste collection practice at each ward/
1	241	The is no waste collection or segregation, holistically no waste management system is equipped in the ward
2	273	NA
3	572	In few houses no system is available; few houses do compost to manage waste and few other houses throw the waste in the nearby empty plot. 
4	273	In few houses no system is available; rest of the houses dump their waste at the empty plot
5	...	Waste is burned, that is, incinerated at the backyard of their houses
6	250	Open dumping is the major issue in this ward, that is throwing it in the nearby empty plots
7	268	Open dumping is the major issue in this ward, that is throwing it in the nearby empty plots.
8	...	NA
9	315	Open dumping is an issue but few of the houses in the ward follow composting to manage the waste material



8.7.2. Existing guidelines, Policies and Best practices

Onto the existing scenario for waste management, the method that seem hazardous to the environment are eliminated and new techniques has to be brought, so that waste is managed in an efficient way and utilized in an environmental friendly method.

- Holistic waste management system: For non-recyclable waste they are managed at the site from the household level, that is, collecting and segregating the waste at the houses, the waste that cannot be compost is given to the collectors for recycling. Those waste that are neither meant for composting nor are non-biodegradable are made into new products. This way the non-biodegradable wastes are managed to be reused efficiently without harming the environment.
- Composting at household level for the kitchen waste and other house wastes.
- Thin plastics conversion to reusable fashionable bags by upcycling method (*IT professional show india how to turn waste plastic bags into fashionable handbags, 2018*).



Figure 8-23 From linear to circular holistic waste management practice,

- Planting the species like canna indica near the backyards of the toilet, so that the soap water can also be break down at the soak pits (*Ecological sanitation practitioner's handbook, 2011*)
- Bio-digesters for managing the human waste and utilizing it as resourceful nutrients, biogas as the system dissolves the waste to utilized products (*Karthik rajendran, 2012*).
- These methods in a holistic way, when equipped in Uppunda starting from the houses, then at community level, at the whole of Uppunda is easier to then manage the waste and bring it into a structured pattern.

8.7.2.1. Holistic management System

The holistic management of waste can be structured in a linear waste disposal and circular waste management approach. At the linear approach, the waste at the source that is unsegregated is put into the community level bins, collected, transported, and is dumped to the nearby landfills. To avoid dumping into the landfills circular waste management approach is countered at the source to whole of the place. From the source waste is segregated to dry, wet, and hazardous waste and is collected at community level where secondary segregation happens. From this secondary segregation the wastes are broken down and is collectively equipped in each genre corresponding to the nature of waste material. This can be categorized to compost, new recycled products, converting waste into some form of energy; for example bio-gas for cooking and the toilet waste water converted to clear water, to water the field, garden which acts as the manure to the soil etc.

8.7.2.2. Composting at Household level

There are different categories in composting the waste material such as aerobic composting, anaerobic composting, vermicomposting, composting at pits. The best practice for the place is digging an compost pit and planting a banana planter or a coconut sapling to the pit so that the compost underground made of biodegradable household waste acts as a catalyst in the growth of the sapling. The figure 8-24 portrays the method of compost formation to be the manure to grow the sapling. The process portrays at houses the organic kitchen waste and the left-over food waste is put together that is recycled to form compost. These composts are soiled to the saplings to nurture the growth of the plant.



Figure 8-24 General composting method,

Source: (Pena's disposal service, leading the way to zro waste, n.d.)
Author.

8.7.3. Nivedha Trashbots

The invention of trashbots by Nivedha a Bangalore based girl is to segregate mixed waste material in a technical approach and as the bot does it with the help of the moist content as the key component, that is, 40% of the moist is contained in the non-biodegradable waste and the 90% of the moist is contained in the biodegradable waste. Initially this invention was a prototype to 1kg capacity whereas and when it was found to be working the capacity of the system was increased to 50kg/ hour model. This method can be equipped to eliminate landfills and transportation of carrying these wastes to landfills.

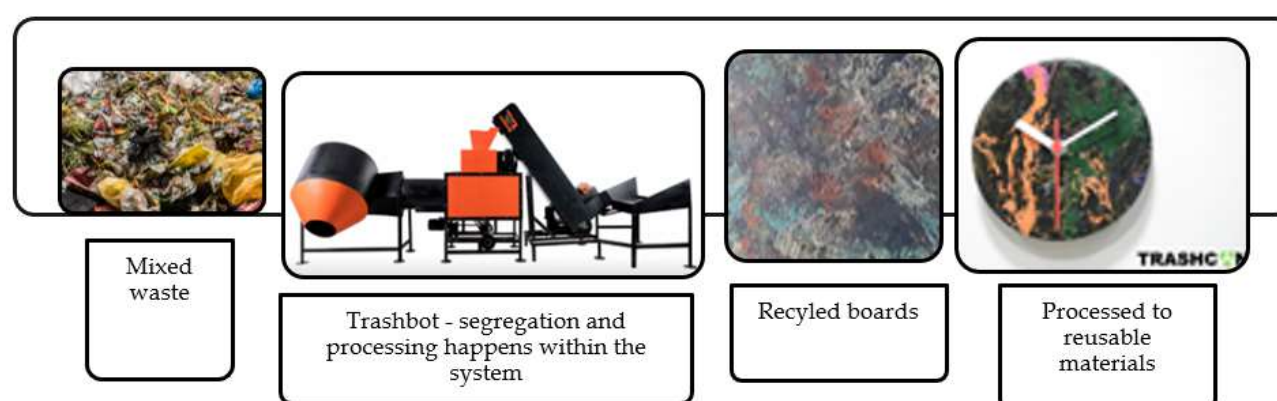


Figure 8-25 The process of Trashbot model by Nivedha, Source: (Trashbot by Nivedha - The waste segregator is currently available in four capacities—500 kg, two tonnes, five tonnes and ten tonnes. By: ARANHA, JOVITA, 2019)

Segregating waste was very easy through the trashbots and the these were categorized to 500kg, 2 tons, 5 tons and 10 tons capacity (ARANHA, 2019). The segregator, that is, the trashbots has a dumping bin, magnetic separation system, loading conveyor and a shredding unit which comprises of high pressure and speed fan part and a conveyor. The process at which the trashbot work, the collected mixed waste material is put into the dumping bin of the segregator. As the wastes moves into the magnetic separation part of the system, here all the metals, batteries are segregated, and the other waste material is sent to the shredding unit by the loading conveyor. In the shredding unit the plastic that contains the food particles are shredded to reduce the surface area of the plastic so that the food material cant be stuck to the plastic, upon which these sheets are tempered in front of the high speed and pressured fan. This separates the biodegradable waste to the conveyor near the fan and the non-biodegradable is collected separately, where biogas and compost are generated from the biodegradable waste and recycled boards from the non-biodegradable waste.

8.7.4. Thin plastics to fashionable accessories – upcycling method; case study in assam

The most threatening part of waste is the plastic waste, that are thrown into the environment and is hazardous to the environment, the places wherever the plastics are littered are vulnerable for pollution, for example the plastics littered in



the natural course of water acts as a threat to the water ecosystem, when burned causes toxic fumes which is hazardous to the health condition and to the environment.

Amita Deshpande and Nandan Bhat made it simple to handle these plastic wastes, also generating work opportunity for the people at the rural areas. The technique used to convert the plastics to fashionable accessories is upcycling. The process starts with washing, drying the waste plastics material and these bags are shredded to thin strips, these strips are woven with the help of the handloom chakras into a cloth or a fabric. Then these cloths or fabric is made into new products for regular usage, through this process the plastics are made into laptop bags, notebook cover, doormats, wallets, purses handcrafted handbags etc., thus the reuse of the plastic waste is not harmful for the environment but also creates opportunity to the environment. These bags or any products can be utilized long as these products have long durable. This system also creates job opportunity, they have also established a setup at the tribal hamlet of Dadra nagar to also create work opportunity for the people mainly women and the youth of the village, Uttar Pradesh.



Figure 8-26 New products made of plastic waste (b) Handloom chakra to weave the thin sheets of plastics to new products; Source: (IT professional show india how to turn waste plastic bags into fashionable handbags , 2018)

8.7.5. Bio- digesters

There are techniques that can be followed at the household level to effectively utilize the toilet waste into other means of energy to the environment (manure to the soil, biogas can be used for cooking etc.,). Also, the toilet waste in the existing scenario has no proper system of network but bio-digestors is an effective technique to digest the human waste with the help of inoculum bacteria, that is, present in the bio-digestors chamber part. These can be placed a bit above the groundwater table to hamper the seepage of the grey water and groundwater.

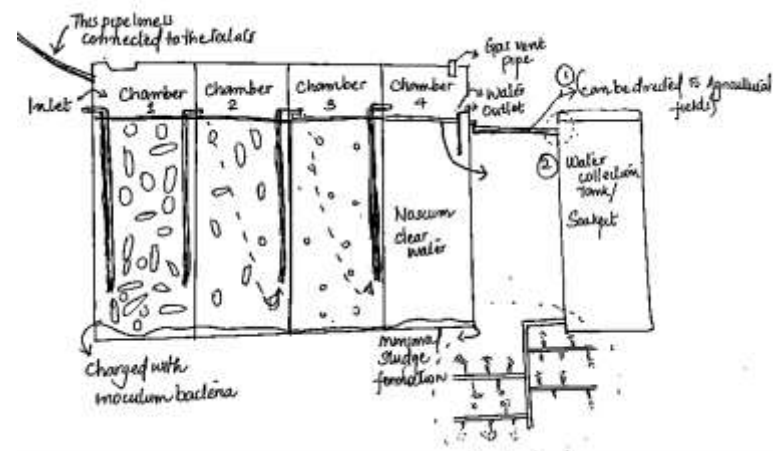


Figure 8-27 : Process of the bio-digestive system

In the bio-digestive system, the toilet is connected to the inlet of the bio-digesters so that the human waste falls in the chamber1 where the inoculum bacteria are present. This bacterium digests the human waste and sludge is formed which settles at the bottom of the chamber. Water, that is at excess overflows to the chamber 2, the water that is overflowed into the chamber 2 is with less harmful matter, when compared to the water that was drained from the inlet pipe to the chamber 1.

From the figure 8-27 there are four chambers for treating the water system alone, and then the chamber 4 after the process, the water is sent out through the outlet to the water soak pit. These chambers can be reduced with respect to the capacity of the water that has to treated. This system is a cost-effective technique where one-time installation charges and maintenance is much lesser. The treated water from the digesters can be utilized for the agricultural purposes and on to the fields etc. the gas emitted out is biogas and it can be utilized for cooking gas.

8.7.6. Swachh India (Govt. Scheme)

The schemes that the government has given maintains India a clean and healthy environment to live in, that is to attain the Swachh Indian moto. Waste is managed with regular collection and waste disposal system; if in case the plastic wastes that are used is thrown is thrown without any any proper disposal criteria then there can be spot fines.

The non-biodegradable material can be collected at the sale part, that is, at the shopkeeper handle, so that the shopkeepers get some incentive to bringing in the alternative packaging material. When the plastics are eliminated at the place of origin itself the threat is much less at the village level, else a waste collector can also collect it and try to reutilize them or send it to the recycling unit.

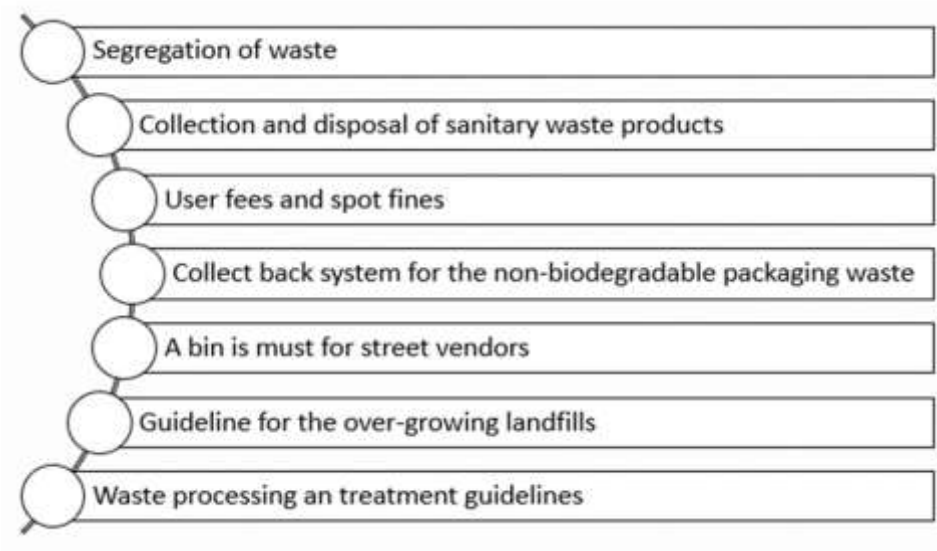


Figure 8-28 : Process of waste collection



9. Proposed Masterplan and Recommendation

9.1. Vision Statement

“Developing a sustainable coastal village that assures livelihood security of the community & socio-economic development through capacity building, while preserving & managing the resources responsibly by respecting the coastal ecosystem.”

Goal 1: Coastal protection	Objectives: <ul style="list-style-type: none"> Shoreline Protection, Reducing salinity due to salt water intrusion, Protecting the marine ecology, limiting human intervention in sensitive areas of coast and sea (fishing), following CRZ rules, controlling settlement density, Flood resilient structures, Enhancing traditional practices related to fishing & agriculture
Goal 2: Community development	Objectives: <ul style="list-style-type: none"> Creating alternative job opportunities, employment generation & trade, establishing home product industries, Preserve the cultural & traditional practices
Goal 3: Improving overall infrastructure	Objectives: <ul style="list-style-type: none"> Accessibility – road connectivity, Improving health & education facilities, Improving drinking water quality, Development of allied housing infrastructure.
Goal 4: Efficient Waste Management	Objectives: <ul style="list-style-type: none"> Value waste as a resource, Decrease consumption and increase the recycling of paper and plastic waste, Bio-degradable alternatives for packaging, Adopt an- AVOID REDUCE REUSE RECYCLE policy, Create awareness in community about segregating waste at source

Figure 9-1 Village Development Goals

9.2. Proposal Brief

The major concept that has been considered for Uppunda Spatial Development Proposal is to integrate the inter-relationship between sustainability, livability and settlement planning. Since settlement plays an important role in creating human civilization by providing space to meet the present and future needs, the shoreline protection had been emphasized with support infrastructure challenges were addressed in the proposal like road infrastructure, housing infrastructure, waste management strategies and water quality as integral part for sustaining life. Livability, an ideal condition where a settlement or city can adapt to create an enjoyable life to maintain and even improve the quality of life, had been addressed through alternate job opportunities through tourism practices and generating income through cultural and traditional practices through homemade product manufacturing and marketing. This improvement in the quality of life will further lead the inhabitants to develop a sustainable city. Therefore, livability as the implementation of sustainability in the context of the local community which has been given the most emphasis in the proposal. The major interventions in the development proposal are enlisted below under these major aspects:

- A. Coastal Protection:** Improving shoreline by retaining the natural ecosystem, with soft engineering techniques; enhancing it further with native vegetation.
- B. Sustainable coastal fisheries development:** Fisheries production also plays a critical role in food security and livelihood in rural areas. The overall objective is sustainable coastal fisheries development to overcome the issues of reduction in marine fish production and safeguard the livelihood security of fisher folks.
- C. Enhancing Neighborhood level development:** At the neighborhood level the opportunity for the community on enhancing the living standards with the proper utilization of natural resources ensuring cultural identity and safety for the inhabitants (Community workspace, waste management).
- D. Sustainable beach tourism:** To maintain the balance between tourism's economic advantage and environmental sustainability, beach tourism in Uppunda will lead to community development by providing employment opportunities for the locals and overall infrastructure development.

- E. Skill development and Vocational Training Centre:** To enhance the employability among women, unemployed people and youth members in the coastal villages of Uppunda through Vocational and Skill training Centre.
- F. Economic Development Center:** This market space helps to create and satisfy the needs of rural market and encourage economic development, create balance between economic and social development. It is beneficial to small scale business setup and marketing from one place. It creates job opportunities which will reduce the unemployment.
- G. Road Infrastructure:** Providing an external loop system with existing roads to form a ring road for the coastal village to allow traffic movement and access to coast without hampering the privacy and daily activities of the village. Along with this also improving the current road infrastructure by way of repair and maintenance to solve issues of localized flooding and accessibility.
- H. Housing Typologies & Design and Construction Guidelines:** To analyze existing issues regarding housing and provide appropriate design & planning guidelines for future construction/ renovation/re-construction which is in accordance with the natural setting
- I. Water Management:** To overcome the critical issues of shortage and salination with the help of preventive measures and methods and create a sustainable livelihood.
- J. Waste management:** To propose a holistic solution for the system to manage waste in terms of the waste collection and segregation in Uppunda.

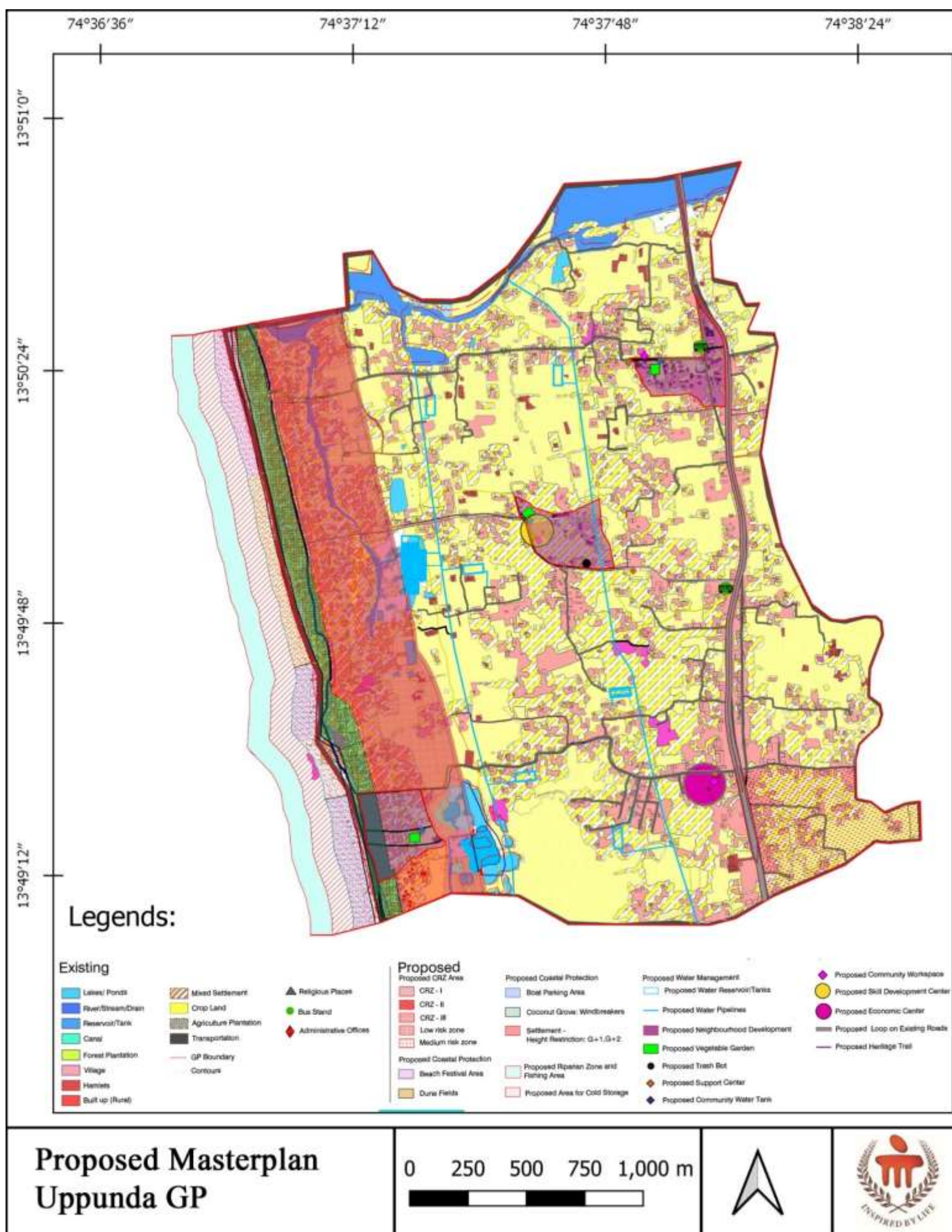


Figure 9-2 : Proposed Master plan at Uppnda Gram Panchayat

9.3. Recommended Guidelines for Spatial Development Proposal for Uppunda Village

9.3.1. Coastal Protection through propagating Coastal Vegetation Growth and Landforms for Uppunda Village

The CRZ guidelines of Udupi District in accordance with provisions of CRZ notification 2011 need to be followed for Coastal Zone Protection for Uppunda Village. The details of the activities which are permissible and restricted, permission for clearance, norms for regulation of activities to be referred in Annexure-8.1.

1. CRZ - I, II, III should be strictly followed by the people of Uppunda.
2. In the coastline 500m and beyond from the HTL should be considered as no development zone.
3. The installation of sand fences (for developing sand dunes and berms naturally) - cost-effective method of inducing accretion of sand.
4. Fences are built from evenly spaced thin wooden vertical slats connected with twisted wire, planting of dune vegetation to be done once sand accumulates.
5. **Zone1:** As described above, proposed sand dunes or berms with the shallow rooted grass creepers (ipoemia and verviter) are proposed.
6. **Zone2:** Proposed vegetation with shrubs and smaller plants- these will prevent soil erosion and accretion process as these roots holds on to the soil.
7. **Zone 3:** Close to the hinterland with deep rooted trees- in case of Uppunda there are coconut trees already present. This will have a twofold benefit- one being they will act as wind breakers in case of storm, two being deep-rooted they will stabilize the soil and reduce erosion and therefore it is recommended to be preserve these trees.

9.3.1.1. Protection of Mangroves

These will act as **Bio-shields**, protect Coastal Communities from cyclone, flooding, and storms.

Existing Mangroves: need to be protected as they are important biosphere that house various flora and fauna like: snails, barnacles, sponges, mollusks, mudskippers, crabs, orchids, lilies, ferns, mussels, spiders and indigenous insects, etc. that depend on its root system.

New Mangroves: saplings can be extracted from existing plants and planted along the north edge of the village- this will help to control the erosion and stabilize the banks. It will also help fix the impurities that are currently present in the estuary due to sewage and solid waste disposal.

9.3.1.2. Sand Dunes

These will act as First line of defense. They need to be stabilized by using coastal vegetation (list provided in Annexure) so that they are not blown inland. Presence of Dunes indicates ecological equilibrium between sea and land It will act as a source of nourishment for coastal flora and fauna, additionally it will also replenish and propagate more dunes. For Community it is an ideal recreational place. It protects coastal communities from strong sea-winds, it is important to protect them from sand mining and other industrial use.

Formation of Sand Dunes: Uppunda has a very narrow strip of dry sand of 100-110 m (average) from HTL available. This area requires sand dunes coupled with dune vegetation (list in Annexure 01).

9.3.1.3. Sustainable coastal fisheries development in Uppunda Village

The key recommendations for the Coastal Fisheries Development for the village:

- A. Protection and replanting of mangrove + Raising Casuarina plantation (Formulation of action plan for replanting of mangrove in lands where they have disappeared. To be taken up in conjunction with protection of mangroves, patches of biodiversity rich habitats in the coastal, riverine and deltaic belt.) Coastal panchayats be allowed funds for mangrove and Casuarina planting. Incentives to be given to village Self-Help Groups and other village level organizations for raising and maintaining mangrove and Casuarina forests. Forest Department to play important role in raising mangrove & Casuarina vegetation.



- B. CRZ regulations do state fish breeding areas to be treated as CRZ I. The Department of Fisheries in collaboration with the National Bureau of Fish Genetic Resources are the implementing Organizations for the same.
- C. Limited entry, reduction and “far sea” fishing.
- D. Implementation of code of conduct for responsible fishing.
- E. Strict implementation of uniform “closed season” for marine fishing for the entire west coast.
- F. Priority steps to be taken to identify fish breeding grounds and other sensitive areas and such areas be declared as “marine protected areas”.
- G. Periodical ban on catch and sale of over-exploited fish species to be implemented.
- H. Mesh regulations of nets necessary to exclude juveniles and non-target species.
- I. Resource enhancement programs to be organized.
- J. Provide alternative employment for the fishermen.
- K. Promote mutual agreements.
- L. Development, support for fishery by developing other culture systems similar to the existing ones (CAGE FISHING), Marine culture and Organic Aquafarming Initiatives that is safe and provides good economic returns.
- M. Empowerment of artisanal fishers through social and technology upgrading.
- N. Strengthen marketing system.
- O. Evolve strong fisheries policies.
- P. Provide machinery for implementation.
- Q. Promote participatory management.
- R. Provide adequate funds for fisheries management.

9.3.1.4. Conserving Biodiversity

The coastal habitat and marine environment offers areas for reproduction, recruitment, feeding and shelter and should be protected. Coral patches abound off the southern part of the southwest coast of India. These coral reefs exhibit rich biodiversity and provide nursery grounds for commercially important fishes and need to be conserved. For safeguarding the biodiversity, the following are the recommendations (Detailed in Annexure 8.2) which can be incorporated in the proposal.

- I. Establishment of seabird conservation sites.
- II. Establishment of protected areas for threatened estuarine fishes.
- III. Promoting sustainable utilization of marine/estuarine fish.
- IV. Safeguarding the livelihood security of artisanal fisher folks.
- V. Pollution control in the prawn farms.
- VI. Protection of ecology of sea shores.
- VII. Promotion of eco-tourism in beaches.
- VIII. Establishment of lake/tank/reservoir centered biodiversity conservation.

9.3.1.5. Mangrove planting and protection

Mangrove forests have specific ecological role in the coastal ecosystem. Mangroves serve as nursery for many species of finfish and shrimp and needs to be conserved. Protection and replanting of mangrove + Raising Casuarina plantation (Formulate an action plan for replanting of mangrove in lands where they have disappeared. To be taken up in conjunction with protection of mangroves, patches of biodiversity rich habitats in the coastal, riverine and deltaic belt.).

The estuaries maintain high levels of biological productivity and play important roles in:

- I. nutrient and organic material transport through tidal circulation,
- II. nursery grounds for many species of shrimp and fish, and
- III. breeding grounds for caridian prawns.

9.3.1.6. Riparian Zone

There should be designated riparian zones which will act as a terrestrial biome and help to stabilize the area around these ponds/catchments. It will also help the soil around to not be eroded during heavy rains when the

surface runoff is high. It will also purify the water in the ponds and propagate aquatic life. By acting as buffers between upland areas and open water, they help filter pollutants such as nutrients and sediment. Healthy riparian vegetation helps to reduce stream bank erosion and maintain stable stream channel geomorphology. Vegetation also provides shade, which works to lower water temperatures. They include the floodplain as well as the riparian buffers adjacent to the floodplain. A riparian buffer is usually split into three different zones, each having its own specific purpose for filtering runoff and interacting with the adjacent aquatic system. Buffer design is a key element in the effectiveness of the buffer. It is recommended that native species be chosen to plant in these three zones, with the general width of the buffer being 50 feet (15 m) on each side of the stream.

9.3.1.7. Identification of coastal aquaculture and Mari culture sites with MSP

One of the options to tide over the situation of reduction of marine fish production is regional level planning to increase fish production from available water resources. Therefore, it is essential to have an integrated spatial planning of the available water resources as it has multiple uses, that is, Marine spatial planning (MSP) and aquaculture zoning.

9.3.1.8. Safeguarding the livelihood security of the artisan fisheries

The near-shore waters, to a specified distance, to be reserved for fishing by artisan fishermen only, who use Rampani nets, caste nets, hooks, canoes and other non-mechanized crafts. The artisan fishermen may be exempted from the fishing ban imposed during the monsoon season. The Coast Guard may be deployed to carry out such regulations. Introduction of limited entry and effort reduction schemes, together with promotion of fishing in deeper, "far sea" areas to reduce increasing fishing intensity. Panchayat-wise yards for preparing dry fish. Promotion of fisher-women's co-operatives is very essential.

9.3.1.9. Promoting sustainable utilization of marine/estuarine fish

- I. Educate fishermen on the pollution likely to be caused on account of throwing away of unwanted fishes both in deep sea and coastal waters and also about oil spills and the need to prevent such actions, fishermen are required to be educated suitably in their regard.
- II. Construction of sea wall affects breeding of fishes. Formation of natural sandy coast (French Technology) could be thought of for the protection. This would also provide breeding ground for coastal fishes.
- III. Priority to be given for Protection of ecology of seashores by raising vegetation and sand dunes. Raising economically important plants such as Honne (*Calophyllum inophyllum*), Honge (*Pongamia pinnata*), Ketike (*Pandanus*) and medicinal plants etc. can strengthen livelihoods of coastal poor.
- IV. Strict implementation of uniform "closed season" for marine fishing for the entire west coast, from 10 June to 15 August is expected to protect the brood stock of fishes from exploitation by the mechanized sector (to protect brood stock of fishes to facilitate breeding and recruitment of their stock). There is a ban period of 2 months -June 10 to August 15 for fishing. However, there has been a trend of excessive fishing just after the ban period which over the time decreases gradually. To impose mesh regulations for the fishing gears in operation in the coast to prevent catching of young (non-target species) and juvenile fishes.
- V. Licenses for additions to the fleet of purse-seines and trawlers should be limited to sustainable limits Soft loans for fisheries sector be limited to traditional fishing communities only so as to safeguard the fish stocks from over-exploitation by outside commercial sector.
- VI. No collaborative ventures for the bottom trawling, very destructive to marine ecosystems, be permitted in Indian territorial waters. Use of large trawl nets to be regulated to minimize incidental catches and other damages to the sea bottom ecosystems.
- VII. Priority steps to be taken to identify fish breeding grounds and other sensitive areas and such areas be declared as "Marine Protected Areas". CRZ regulations do state fish breeding areas mangroves are to be treated as CRZ I. In practice no such areas are identified. Periodical ban on catch and sale of over-exploited fish species to be implemented. Development and support for fishery by developing existing (organic aquafarming initiatives-cage fishing practices) and alternative culture systems that is safe and provides good economic returns.



- VIII. Restrictions on prawn catching during breeding period *Paeneus indicus* —white shrimp- breeds during December to May, *P. monodon* —tiger prawn- breeds during May to October, in bar mouths, estuaries and backwaters. A ban on catching of the above species during the breeding periods has to be recommended.

9.3.1.10. **Strengthening marketing system by creating cold storage chains**

There should be proposed cold chain infrastructure to improve the nutritional status and food security by augmenting national fish production so as to minimize post-harvest losses, improve quality and safety of fish products to acceptable standards.

9.4. **Sustainable Beach tourism and Heritage walk in Uppunda Village**

9.4.1. **Conservation of Cultural heritage**

The connectivity of the natural and cultural heritage should be established by creating Sociable Community Spaces for enhancing worship spots and well areas. This should be promoted and encouraged by enhancing the places of religious importance such as tree katte, stone worship shrines, etc. This shall be resulting in creating awareness about mythological, historical and religious information of the village.

Karnataka Tourism policy focuses on going beyond mere tourist numbers and make a strategic shift towards quality tourism. This will emphasise hospitality, service standards, innovative developments and rejuvenation of older tourist attractions, with the aim of offering visitors the experience that will be commensurate with higher expectations, while preserving the rich heritage of the area.

The aim of the policy is "To develop Karnataka as a safe, sustainable and most-favoured tourism destination - by increasing domestic & international visitations; offering high quality experience to visitors; facilitating and accelerating investments; and improving livelihood opportunities at the local level.' Mission

- I. Promote tourism products and services which will encourage repeat visits, increased length of stay and spending by tourists.
- II. Preserve the social and cultural fabric of the state, while stimulating economic growth and raising quality of service to global standards.
- III. Protect the environment & ecology and encourage safe, sustainable and responsible tourism in the state.

To achieve the vision, mission and set the direction for the tourism industry over the next five years, the following objectives are outlined: Accelerate and facilitate private investments; and encourage entrepreneurship in the tourism sector.

- I. Motivate and enthuse different segments of the society to contribute towards development of the sector.
- II. Provide a 'total quality' experience to visitors, from before arrival till after departure.
- III. Facilitate effective interdepartmental co-ordination, streamline processes to improve sector performance.
- IV. Enhance skills, knowledge and professionalism in the tourism industry.
- V. Encourage local employment opportunities.
- VI. Support the use of Information & Communication Technology (ICT) based initiatives in improving quality of services to tourists.

Some key points from the Karnataka Tourism Policy which are relevant to the scale of Uppunda under various categories are stated below.

9.4.2. **Improve Infrastructure, Tourism Products and Services**

Rural Tourism

- Rural tourism will be encouraged to showcase rural life, art, culture, cuisine and heritage at villages/ countryside and will provide opportunities for economic and social development of the local communities.

Religious Tourism

- Karnataka is home to many famous temples and pilgrim sites in the country. The rock cut cave temples and the architectural monuments built by various dynasties are important attractions in the state.

- Efforts will be made to encourage tour operators and facilitate pilgrimage tourism between various religious attractions.

Last mile connectivity

- Improving last mile road/ rail connectivity to tourist destinations such as, multiple transport options links from railway stations and bus terminals, etc. would be emphasized and the Department of Tourism would co-ordinate with other government agencies/ departments in facilitating these developments.

Access and delivery of tourism information and other services Tourist Amenities/ Kiosks

- Development of tourist amenities such as information kiosks, trained guides, audio guides, interpretation centres, etc. would be encouraged at all major tourist destinations.

9.4.3. Information, Communication & Technology (ICT)

- Initiatives to provide adequate and reliable information about destinations, accommodations, itinerary, events, online bookings and other offerings through various modes such as online web portals, mobile applications, tourism offices, flyers, brochures, maps, etc. would be encouraged.
- Provision of audio guides, mobile technology, Wi-Fi facilities at major tourist destinations would be encouraged. v Technology interventions for social networking and data management would be encouraged in order to support tourism activities in the State.
- Digital marketing, information collaterals, and development of information and interpretation centers at tourist destinations will be supported and encouraged. Safety and security of tourists
- The tourism police force referred to as the “Tourist Mitra”, would be deployed for visible policing in key tourist destinations for the safety and security of visitors.
- A disaster management plan is proposed to be developed for major tourist destinations in order to be prepared for any eventuality.
- A dedicated helpline number would be launched exclusively for the convenience of tourists.
- Convenient and safe access for differently-abled persons would be emphasized at all major tourist destinations.

9.4.4. Tourism products and services

- Facilitate ease of doing business by fast tracking approvals and clearances. Project specific land acquisition processes, concessions and investment subsidies would be facilitated for private enterprises seeking to establish mega projects and entertainment products.
- Strategies for development of tourism in places such as Melkote, Somnathpur, Shravanbelagola, Talakad and the entire Western Ghats would be formulated to encourage overnight stays through compelling experiences and engaging activities.
- Adoption/ management/ sponsorship programs in heritage zones would be supported to create ownership between locals/corporate for monuments, temples and destinations and to improve the maintenance of existing tourist destinations.

Marine/ Coastal Tourism

- Trekking and nature walks would be actively encouraged to provide tourists an exposure to natural environments.

Training / Capacity Building

- Efforts would be made to collaborate with experts and resources available with international tourism training organizations towards developing a Karnataka Tourism Human Resources Strategy.
- Emphasis will be on developing a strong Human Resource Policy that enables the community to seek employment in the hospitality and tourism sector. v Training would be imparted to government officials, guides, hospitality staff, including homestay hosts, tour operators

Vocational Skills Training

- Keeping in mind the additional employment possibility that the tourism sector would generate in the next five years, efforts would be made to introduce training for tourist guides and support staff in housekeeping, front office, reception, and other areas of hospitality. Convergence of programmes with education department



and other departments would be considered to ensure availability of larger work force in non-core areas of hospitality, such as security, kitchen stewarding, maintenance and cleaning services.

Capacity enhancement at local level

- Education and enhancement of competencies for local communities in the vicinity of tourism clusters would be encouraged, in order to catalyse economic opportunities from tourism activities.

Tourist Information System

'Tourist Information Kiosk' is a kiosk located at a public place or at transit points such as bus station, railway station, airport, sea port, etc.; providing basic information to tourists; including but not limited to the following;

(a) Tourist maps of destinations

(b) Nearest basic amenity such as hotel, restaurant, busstop, railway station, etc.

(c) Tourist destinations in the State

(d) Emergency contact numbers - police, fire, hospital, etc.

(e) Modes of transport and means to reach destinations Tourist Information Centre 'Tourist Information Centre' is a facility located at a public place or at transit points such as bus station, railway station, airport, sea port, etc.; which in addition to providing basic information to tourists, also enables hassle free travel/ tour/ stay for tourists.

Macro Level Guidelines:

- Conservation of specific coastal landscapes and habitats that make the area attractive.
- Events and Festivals of the locals communities.
- Limit the visitors at the beach 500 at a time to limit the gathering post covid. Also this let people spend more time at the waiting area which can lead to income generation.
- Limit the Parking time for the regular movement of the tourists.
- Allow only the public vehicles till the coast line to avoid traffic congestion .

Micro Level Guidelines:

- No permanent construction along the coast
- Small temporary kiosk by the locals to sell the local products to decrease the food mile and income generation.
- In case of overcrowding during the festivals visitors should be moved to nearby beach to avoid overcrowding.
- Weekly activities should be organized by the local tutors for the visitors to learn local art or activities like yoga, water sport etc.
- Increase community solidarity
- Public-private partnerships in tourism development programmes.

Beach Tourism and Income Generation

Improving tourism in the village will helps in enhancing the importance of heritages as well as other cultural elements of the place. This can also provide alternate employment opportunities for the community in off-season and helps in generating income for local government. The locals residing can setup temporary shacks for income generation during festival and non-festival time for the tourists to promote beach tourism. It shall help in preservation of local culture.

9.4.5. Heritage Walk

The people in the village have strong sense for the culture and its protection. The major circuits loop for strengthening the tourist visit need to be proposed after identifying the major landmarks including the tourist trail with Ped-shed analysis for the pause points.

9.5. Enhancing Neighborhood level development in Uppunda Village

To enhance the cultural identity and safety between the people living in the Uppunda village, there is a need for development through enhancing neighbourhood planning.

- I. Improving community social interaction within the village.
- II. Creating awareness about heritage management of the village by digital display system.
- III. Introducing Tele-medicine facilities.
- IV. Use of locally available and resilient building materials.
- V. Awareness program should be given to the villagers in maintenance, care and harvesting techniques of the community garden.
- VI. Incentives should be given to the villagers for buying garden equipment's, tools, getting vegetable seeds and organic manure.
- VII. Improving food security in the village by vegetable garden.
- VIII. Use of saline tolerant vegetables and fruit plants for effective production of yields.
- IX. Cattle farming can be promoted so get organic manure for the vegetable garden.
- X. These well position should be placed far from the toilets (septic tanks) of the household so that the grey water mix (because of the characteristic of the soil) does not happen.
- XI. Vegetable garden should be placed close proximity to the proposed community well.
- XII. Size for the community gardens should be fixed based on the need of harvest for the selected area.
- XIII. Community vegetable garden yield can be used for the economic development as well as for tackling food security within neighbourhood.
- XIV. Providing utility space along with community wells for domestic needs depending on the needs of neighbourhood.

9.5.1. Delineation of the demo areas

The neighborhood development planning process seeks for firstly the delineation of demo areas in the village on the basis of selecting areas from the wards near the coastal area, wards near to the National highway and one area in the wards between the wards in coastal area and near National highway.

9.5.2. Community Wells

Community wells not only tackle the issue of drinking water shortages but can be considered as an effective place to improve the interaction within the communities. The proposed Community wells in Uppunda can act as a place for social interaction within the neighborhood and also creates a sense of unity between the people. They shall be proposed in designated demo areas overlaying with contour map with the existing settlement pattern.

9.5.3. Neighborhood level Vegetable Garden

Neighbourhood level vegetable garden can act as an interaction space for the villagers in neighbourhood and improves teamwork and also enhances food security during off-season and enhance women participation which further generates income. Considering the climatic conditions of Uppunda salt tolerant vegetable can be chosen according to the site conditions. Also community level vegetable garden can improve safe and hygienic neighbourhood which also provides fresh food and improves community health.

- I. Incentives should be given to the villagers for buying garden equipment's, tools, getting vegetable seeds and organic manure.
- II. Awareness program should be given to the villagers in maintenance, care and harvesting techniques of the community garden
- III. Should be placed close proximity to the proposed community well. Size for the community gardens should be fixed based on the need of harvest for the selected area.
- IV. The position of vegetable garden should be like it should get maximum sun light. So, it is ideal to keep it north-south direction. Cattle farming can be promoted so get organic manure for the vegetable garden.



9.5.4. Neighborhood level common working space:

Neighbourhood level common working space needs to be proposed which promotes all age group participation in a single place. It helps to exchange ideas and improves coordination within the neighbours. It also helps in forming small partnership for household industries and in turn helps in increasing the productivity.

- I. Locally available materials can be used for the construction of community working space like coconut leaves.
- II. Handloom chakras can be provided in the common working space.

9.5.5. Support Center:

Support centers can be placed along with the existing temples or other religious spaces or even in some public buildings, so that maximum number of people will be given awareness regarding environmental health, public health, also can give awareness regarding the history and culture of the place. For this interactive display screens are placed so that students and other people can come in a common place to get awareness and information.

9.6. Skill development and Vocational Training Centre

The Uppunda Gram panchayat aims at an inclusive skills development strategy as well as learner and productive jobs focused in its strategic approach to gain the maximum demographic dividend possible for steady, balanced socio - economic development and equitable growth, leading to decent job opportunities for all and to ensure the employability in among women, unemployed people and youth members in coastal villages of Uppunda through vocational and skill trainings centre.

9.6.1. Skill Development and vocational Training center:

To enhance the employability in among women, unemployed people and youth members in coastal villages of Uppunda there is a need for intervention for proposing vocational and skill trainings center.

- I. To provide adequate built environment that meets the minimum space requirements, as per applicable category of PMKK.
- II. To provide a platform for women, unemployed people and youths to enable them to take up skill training and become employable and earn their livelihood.
- III. To incorporate low cost and efficient construction technique as well as use of prefabricated construction methods.
- IV. Provide awareness and mobilize young people, entrepreneurs and informal staff on employable skills and organizations offering those skills.
- V. Make vocational training idealistic both for youth and employers so that youth perceive vocational training as an employment opportunity and employers, recognize the development value of skills, and offer skilled workers remunerative employment.
- VI. Develop and enhance teaching facilities and instructors at all levels and deliver high-quality, effective teaching.
- VII. Equitable and convenient access to training facilities for all vulnerable villagers.
- VIII. Ensure vocational training for school graduates, informal sector employers, low-paid employers and young homemakers to allow them to improve their employability and access growth opportunities through skills, retraining and upgrading.
- IX. Encourage mobility between professional and general education in line with the National Skill Qualifying Framework.
- X. Have appropriate skills to grow entrepreneurship and secure livelihoods.

9.6.2. Formulation for a Core team and training:

A core team should be formulated and give orientation towards the Skill development and vocation training centre. The core team should consist of a Project Coordinator, one Account cum admin assistant and 2 community organizers to achieve all the goals which was identified in formulation of this centre. The staff will be planned according to the course

who will have to provide necessary materials for their understanding and make a syllabus for the vocational and skill development training.

9.6.3. **Signing of Course Curriculum and facilities:**

The training programs comprising of two segments i.e. classroom and Laboratory work. The course wise curriculum will be designed in association with experts from the industries based on market demand and aims at integrating experiential practical learning in the field and theoretical understanding in the classroom. Along with continuous personality development for the trainees is undertaken with the support of identified schemes Pradhan Mantri Kaushal Vikas Yojana (PMKVY) is considered. Learning methods will include observation, discussion, action, presentation and examination. Pre assessment, midterm assessment and final assessment to be conducted at project level as a part of monitoring and evaluation. After the final evaluation, the certificate to be awarded.

9.6.4. **Village Economic Development Center:**

The proposal is need to be developed on the broad objectives for rural development strategies in lines with MSME guidelines. The proposal strives for economic development to build economically sustained within the rural landscape. The proposal comprises Economic Development Centre shall have 3 aspects – a) Centre space which will be accessible for all the rural people b) Creating employment opportunity by encouraging small scale industries c) Trade for agriculture and fishing industries for import and export. The planning phases should include mapping of small enterprises and identifying its potential, facilities for new start up and opportunities for employment. The following guidelines needs to be recommended:

- I. Ensuring equitable wages for men and women, zero child labour.
- II. Rural poor who are in need of wage employment and willing to take up unskilled work can also encourage to join this centre. (Sampoorna Gramen Rozgar Yojana for employment assurance).
- III. Accessibility of the centre is highly recommended. Near to National Highway, important landmark and post office encourage the easy transportation of goods.
- IV. This development centre comprises with production unit, marketing area, Bulk storage area with parking facility.
- V. Semi open market space for encouraging openness and any kind of awareness training.
- VI. Necessary amenities like canteen, toilet complex need to be taken care.
- VII. Building height will be minimum 3m from plinth level.
- VIII. Small scale industry which required heavy machinery single floor with height not less than 4.5 mt.
- IX. For loading and unloading facility inside service road width is required minimum 5 meter.
- X. Provision for E-Governance unit for use of Information and Communication Technology (ICT) at all the level of the Government in order to provide services to the citizens, interaction with business enterprises and communication and exchange of information between different agencies of the Government in a speedy, convenient efficient and transparent manner.

9.7. **Road Infrastructure**

9.7.1.1. **Ring Road (Loop System):**

The loop system can be proposed to improve the road connectivity with internal roads to NH66. It allows for low or medium volume movement as it will connect the coastal part as well which will have special importance for emergencies to have a free movement without the threat of heavy vehicles coming in.

9.7.1.2. **Intervention of Road Edges:**

Existing road sections required to be corrected or enhanced by adding the storm water drainage system and curb issues related to accessibility flooding which is important for activation of the road edges.

- I. Provision of Storm Water Drains
- II. Cambering of Roads

9.7.1.3. **Provision of Street Lights along roads:**

It is recommended to provide solar powered streetlights along the roads which is an alternative way to light up the streets and is sustainable in the long run. This will help keep the roads active at night as well and help in accessing and using the streets even at nightfall. It will help reduce the susceptibility of accidents. Since it is a renewable source dependent technology, it will have a long life although the initial investment will be high cost. But since we receive a lot of rainfall in this area, it is imperative that some provision is made to store this energy to be utilized during non-sunny days.



Spacing of streetlight should be based on the intensity of light, height of the fixture and clearances from tree canopies. White lighting at 25-40 lux for footpaths is recommended.

For pedestrian walk, it is recommended to have light pole height from 3mt to 5tm and for major arterial intersections can be restricted to not more than 12mt.

9.7.1.4. Provision of Bus Stop:

Since all the bus stops are located next to NH 66, it is recommended to locate bus stop withing ¼ mile (400 meter) walking distance as far as possible. All the bus stops must be universally accessible. Connecting path for pedestrian access should be clear of obstructions, firm surface material, well drained. It is needed to consider the impact of stop on adjacent properties. Also. It is required to ensure the clear sightlines on the right side of the bus- no obstructions.

9.7.1.5. Proposal for Street Landscape:

While planning to design a street or enhancing the existing street, it is recommended to include landscape consideration to reduce the Heat Island Effect (HIE) and to enhance the beauty of the street as follows:

- I. Retain existing trees.
- II. Plant deciduous trees to provide shade in summer.
- III. Planting native trees will help to minimize irrigation requirements and prolong tree life.
- IV. Tree grating be flushed with the footpath level which will help in increasing the walkways.
- V. Tree guards can be used for seating on larger space.
- VI. Narrow columnar trees to be used where pavement space is limited.
- VII. Tree guards (with locally made material) should be provided for young tress.

9.8. Housing Typologies & Design and Construction

9.8.1. Design Layout:

It is recommended to follow a courtyard layout system for rural homesteads. A group of separate buildings surround an open space and thus define the courtyard with each building is essentially a one-roomed structure accommodating different functions such as dwelling units for extended family members, kitchen, and granaries. Toilets and outhouses such as cowsheds are located on the periphery of the homestead. To reduce the wind and wave pressure it is very much important to look for orientation of the building based on the climatic responses.

9.8.2. Construction Material & Techniques:

It is recommended to choose the construction material and techniques based on the environmental conservation and disaster resistance.

- I. Encouraging the use of **locally available materials (like laterite and mortar)** with Slopy roof (using Mangalore tile or sheet roof).
- II. Minimum height of the dwelling units to be maintained 2.5meter.
- III. Extended roof eves to prevent direct wetting of walls during rain.
- IV. Rainwater gutters can be used to discharge water away from the hose.
- V. Promoting **cost effective and energy saving technologies** of construction.
- VI. Paying special attention to **disaster prone areas** which have been identified as vulnerable zones through the incorporation of disaster resistant designs in house construction. Including disaster resistant practices in all habitat and housing schemes promoted by the government.
- VII. Organizing **special training programs for masons** and Panchayat presidents for hands-on experience in the construction of disaster proof houses, cost effective and environment friendly technologies. Designating regional nodal agencies to provide advice on disaster resistant construction practices.

9.8.3. Design aspects for floods:

As Uppunda receives maximum rainfall it is slightly prone to floods. Therefore, it is recommended that the material use for dwelling units and design considerations should be taken into care as listed below.

- I. Building heights to be maintained at a minimum of 2.7 mts for the main structure and 2.5 mts (minimum) for toilets located outside the main building.
- II. Toilets, if detached from main structure, should be located within the perimeter of the plot, and at a distance of not more than 5 mts from the house.
- III. Plinth height to be maintained at a minimum of 30 cms from ground level to prevent flooding inside houses.
- IV. Heights of structures to be maintained at a maximum of 9 mts.
- V. Use of laterite & mortar structures with sloping roof using Mangalore tiles or sheet roofing.
- VI. Water-proofing of the foundations, compound wall as well as plinth to be carried out, specifically for residences nearer to the coast.
- VII. Building Form: Flat or low-sloped roofs, overhangs, and gable ends best suited for areas subjected to heavy rains and high winds.
- VIII. Correct orientation of the building which would help reduces wind and wave pressure as angles cut the flow.
- IX. Adequate number and size of windows should be built, oriented along the prevailing wind flow direction to allow cross-ventilation.
- X. Residences near the NH (a proximity of 10mts) need to mandatorily have a compound wall around the plots in order to maintain safety and security.
- XI. Surrounding the plot closer to NH with local plants, will help reduce the noise and air pollution coming from the highway.
- XII. Following an open layout (inverted courtyard layout) for residences nearer to the coast for residents to utilize the outdoor space for various activities, such as, fish drying, drying of fish nets, coconuts, etc.
- XIII. Encouraging the use of locally available materials & installing rainwater harvesting units where ever possible.
- XIV. Rainwater gutters to be constructed and used to carry water down from the roofs of the houses to below storage tanks/pits, which can be further used for domestic purposes, i.e. washing, cleaning, bathing, etc.
- XV. Drainage channels connected to nearby water bodies should be created to prevent stagnation of water within the house plots.
- XVI. Promoting cost effective and energy saving technologies of construction.
- XVII. Paying special attention to disaster prone areas which have been identified as vulnerable zones through the incorporation of disaster resistant designs in house construction.
- XVIII. Including disaster resistant practices in all habitat and housing schemes promoted by the government.
- XIX. Organizing special training programs for masons and Panchayat presidents for hands-on experience in the construction of disaster proof houses, cost effective and environment friendly technologies.
- XX. Flood Resistant Materials: Lumber, Concrete, Masonry, Structural steel, Insulation.
- XXI. Wind Resistant Materials: Roof coverings, Double- hemmed vinyl siding, Wind-borne debris resistant glazing.
- XXII. Corrosion and Decay Resistance: Stainless steel hardware, avoid aluminum, Copper flashing, vinyl flashing.
- XXIII. Moisture Resistance: Wood finishes, avoid exposure of end grain cuts, treated wood, cavity wall.
- XXIV. Termite Resistance.
- XXV. A central open space in houses is preferred as it has better protection from sea breeze and flood water.
- XXVI. A group of houses can share a common space in the centre which would be well protected.
- XXVII. The central part of any home plot should be its highest point, sloping gently (1% minimum slope) to the edges to allow drainage.
- XXVIII. Drainage channels connected to nearby water bodies should be created to prevent stagnation of water within the house plots.
- XXIX. Keeping a small supply of old blocks/bricks at handy in case they need to be used as steppingstones to connect the separate structures within the same plot in case of water-logging.
- XXX. Main entry into the compound should be raised to allow access during flood times.
- XXXI. A possible raised area for shelter to provide flood relief to the people.

9.8.4. Design Consideration for Plinth:



According to geographical location of the village Uppunda, it is desired to have appropriate plinth to the dwelling units. Therefore, it is recommended that the plinth of the dwelling units shall be design by using Cement- Stabilization, Brick Perimeter Wall and Brick & Concrete Plinth.

9.8.5. Rainwater Harvesting in Household Level:

Rainwater harvesting (RWH) is the most acceptable and sustainable method/solution to attenuate water crisis issues in the both rural and urban areas all over the world. The system involves simple collection and storing of rainwater from surfaces it falls so that it can be used for later use, be it domestic, commercial or for agriculture purposes. Rainwater harvesting, in its broadest sense, is a modern way of saving water at home. Rainwater harvesting has brought more relief during times of droughts. It is the best possible way to save water and invoke the society towards the importance of water. So, it makes sense in today's time to set up a rainwater harvesting system into our existing places of stay. Therefore, it is desired to have rainwater harvesting method for Roof top and surface runoff water.

9.9. Water Management

Uppunda has critical issue with water shortage and salinity. Considering the amount of rainfall received, it is important to retain that water somewhere to tackle the issue of shortage and further reduce its dependency on agricultural practices. Therefore, it is recommended to focus mostly on

- I. Storm water management through Water Retention Pond.
- II. Herringbone System for Drainage Pattern.
- III. Solar Distillation.
- IV. Canal Embankment.
- V. Pond Enlargement.

Under Jal Jnana-Vijnana Mission that will invest substantially in strategies along four dimensions:

- a) expanding granularity and scope of water data gathering, increasing comprehensiveness and reliability, and making data fully publicly accessible in near real-time, coherent, reliable and open access water data compilation system,
- b) creating systems for timely, rigorous and useful analysis of this data for decision support,
- c) supporting the generation of rigorous knowledge generation for the long term, and
- d) building widespread public awareness and support for better water management.
 - I. To strengthen the data gathering through at least 1 observation well, stream gauge and tank/reservoir level monitoring point per Gram Panchayat and all data needs to be validated by independent researchers on a regular basis.
 - II. Participatory approach is mandatory in integrating with the water security planning at village or Gram Panchayat level.
 - III. The water quality monitoring network of drinking water to monitor pollution in surface and groundwater needs to be done weekly to monthly basis by the GP authorities.
 - IV. Metering required both at source level and user level. Metering at source level involves measuring the water flows impounded, conveyed and distributed. Metering at user level is to measure each user's consumption periodically in order 10 to charge for the service.
 - V. Leakage control should be done with the help of proper maintenance by keeping valves clean and repairing in time. Severe penalties may be levied on those found responsible for leakage and wastage of water.
 - VI. Building public awareness through changes in perceptions and attitudes of water users by making them understand the nature and gravity of the water crisis facing by the state and the need for holistic, equitable and sustainable solutions. Mass media and other interactive programs who have both generic and context specific content to build awareness.

9.10. Waste Management

As per survey analysis, there is no collection of waste practices happening in Uppunda. It is desired to segregate the type of waste for recommended treatment methods which will help to promote employment facility for the villagers.

- I. Holistic Waste Collection System.
- II. Composting System.
- III. Trashbot at Site Level.
- IV. Thin Plastics Converted to fashionable Bags.
- V. Bio- digesters.
- VI. Shrimp Farming (Convert chicken & other meat waste for pets feed)

Policies: Solid Waste Management in Rural Areas a Step-by-Step Guide for Gram Panchayats; Swachatha movement at Uppunda is politicized to maintain a clean Village. The waste management needs to be addressed at two levels indicated below:

At Community Level:

- I. Segregating of waste at community level to maintain clean and healthy environment: Community level bins - segregating waste with respect to wet, dry and hazardous.
- II. To have a circular waste management approach; so that the waste generated be it macro or micro level is not sent to the environment instead its reusable and not harming the environment.
- III. The waste generated at the shops, by the shopkeeper; for example: the plastic when wrapped for those goods people buy the shop, retains the level of threat. Because of which alternative packaging material is utilized.
- IV. The waste collector should have a unit at the community level so that the waste generated at the household can be exchanged to him with money or goods.
- V. Both the shopkeeper and the waste collector will get an incentive from the recycling to have managed waste at the community level.
- VI. Avoid, Reuse, recycle must be followed.
- VII. All wards to have prototype for the common work space unit as it is incorporated with handloom upcycling unit to convert plastics to reusable fashionable bags, in turn also generates job opportunity for the people.
- VIII. Conducting awareness program/ campaign to educate the people not to throw waste in the natural course, river to understand the implication and environment hazard caused by these activities.

At Household Level:

- I. Waste is classified to bio-degradable, non-bio-degradable, hazardous and sanitary waste, holistic system of waste management was adapted, so that individual dumping waste in nearby plots; burning waste is prohibited.
- II. Segregation waste must also be followed in the household level.
- III. Decrease consumption and increase the recycling of paper and plastic waste, bio-degradable alternatives for packaging, can give incentives for the people also, to manage waste systematically.
- IV. Bio digesters to be incorporated, at the household level, so that sanitary waste is also a part of the circular waste management system.
- V. When bio digesters are used then cleaning the toilets at with acid at the houses should not happen since acid kills the inoculum bacteria in the bio digesters which is the major source to digest the human waste.

9.11. Design Proposal for Village Spatial Development

9.11.1.Proposal for Coastal Protection

Coastal areas form one of the most unique part of the western Ghats ecosystem. The coast has a lot of natural assets that are needed to maintain the equilibrium between land and sea. According to Patnaik, et.al, 2006, The coastal biota is under serious threat from human activities that lead to destruction of natural ecosystem at an alarming rate. Many natural calamities that arise due to climate change caused by extreme human interventions are rendering the coast vulnerable. This poses a threat to coastal population, habitations, dwellings, property, livestock, agriculture, fishery, infrastructure and so forth. The proposed coastal protection plan is explained in Figure 9.4.



9.11.2. Natural Assets of the Coast:

Sand dunes and psammophytes: These are landforms that protect the coastal environment naturally. These act as natural barriers that absorb energy from sea-winds, tides and wave-action. They come in various shapes and sizes depending on the wind speed, amount of space available on the coast and the type of vegetation around. Following (Fig. no. 9.2) are the types of sand dune formations that are observed in Indian Coasts. These dunes can extend over long stretches and several kilometers inland. The process of formation is such that even presence of one dune will propagate another and so on. Many dunes together will form a dune-field. These dune fields will be made of several types of dunes and provide habitation for coastal flora and fauna. Although these are important features of natural coastal landscape they are not permanent in nature. If these are not stabilized using vegetation, then they may disappear over a short period of time. this is where the psammophytes come in. The plants present on these dunes are called as psammophytes. These species of plants are unique to the dune ecosystem as they thrive in harsh conditions and are crucial to the coast because they can protect it from erosion and flooding. These are non-structural, soft measures and are cost effective.

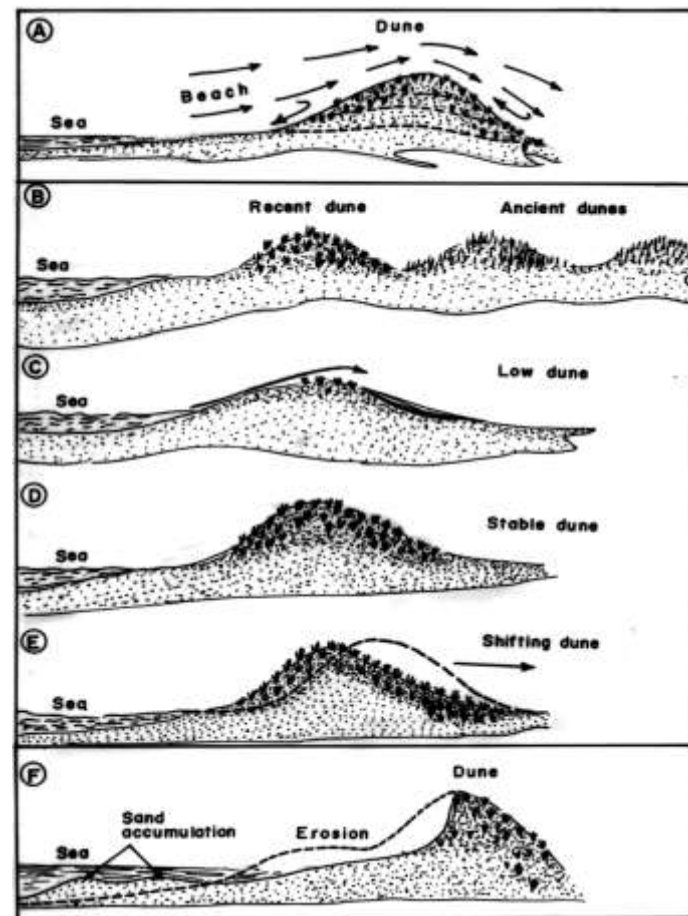


Figure 9-3 Types of sand dunes,

Source: Mascharenhas, 2011

9.11.2.1. Sand dunes: These will act as First line of defense (Figure 9.3). They need to be stabilized by using coastal vegetation (list provided in Annexure) that they are not blown inland. Presence of Dunes indicates ecological equilibrium between sea and land It will act as a source of nourishment for coastal flora and fauna, additionally it will also replenish and propagate more dunes. For Community it is an ideal recreational place. It protects coastal communities from strong sea-winds, it is important to protect them from sand mining and other industrial use.

9.11.2.2. Formation of Sand Dunes: Uppunda has a very narrow strip of dry sand of 100-110 m (average) from HTL available. This area requires sand dunes coupled with dune vegetation (10.8 Annexure VIII).

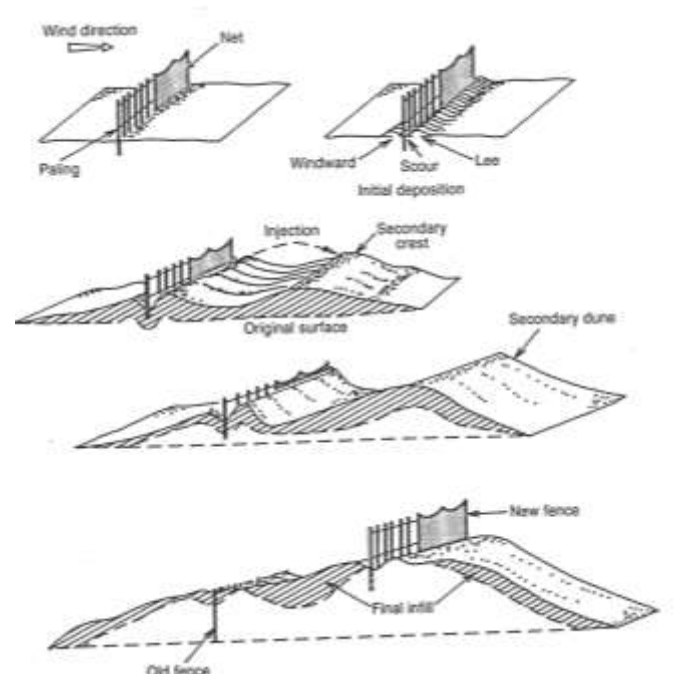


Figure 9-4 Wind leading to the deposition of sand creating a sand dune.

SO

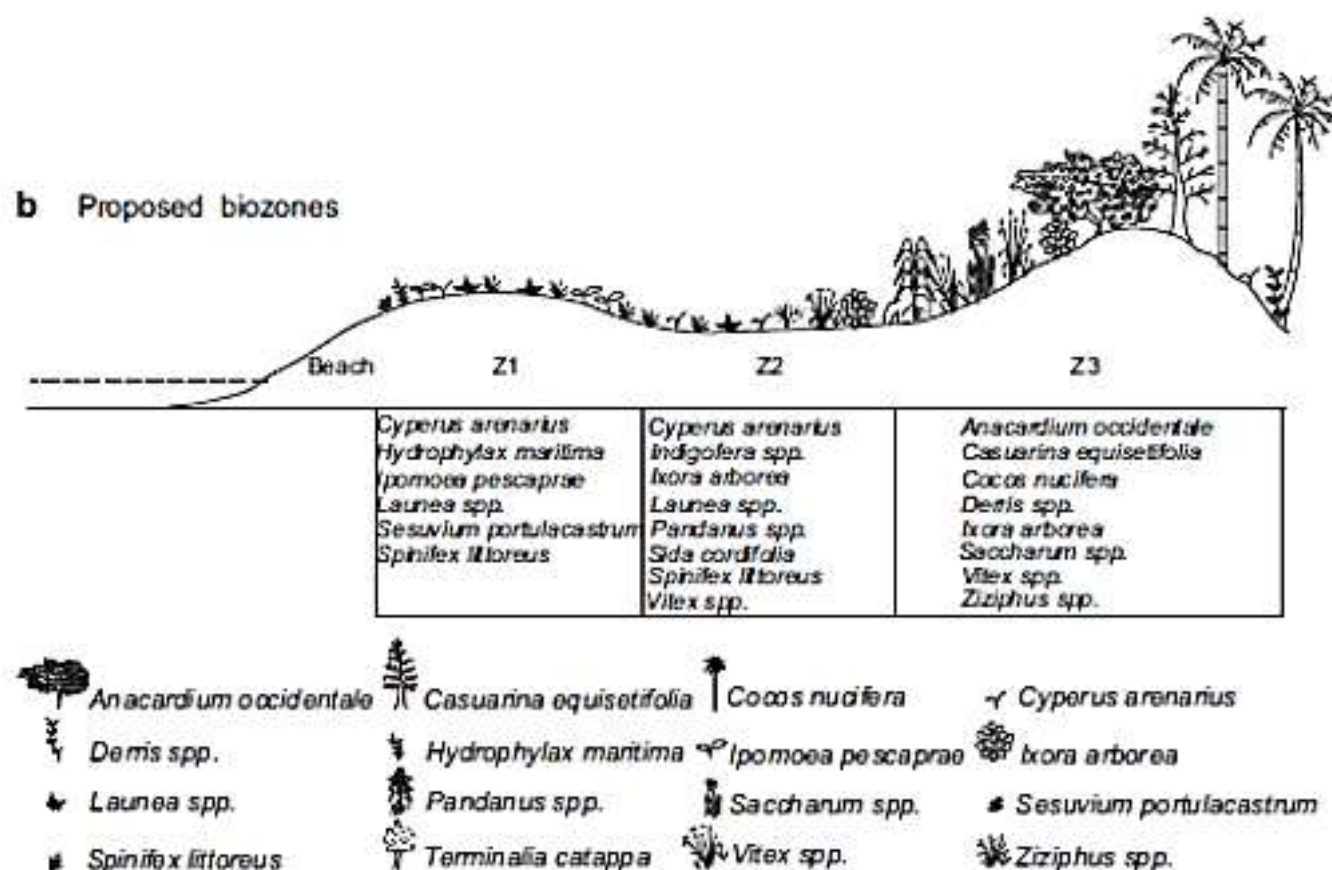


Figure 9-5 Example showing bio-zones for Cavelossim Beach Dune Restoration,

Source: Mascharenhas and Jagtap, 2011, Mascharenhas 1998

9.11.3. Coastal Protection through propagating Coastal Vegetation Growth and Landforms for Uppunda Village:

9.11.3.1 Mangroves: These will act as **Bio-shields**, protect Coastal Communities from cyclone, flooding, and storms.

- A. Existing Mangroves:** need to be protected as they are important biosphere that house various flora and fauna like: snails, barnacles, sponges, mollusks, mudskippers, crabs, orchids, lilies, ferns, mussels, spiders and indigenous insects, etc. that depend on its root system.
- B. New Mangroves:** saplings can be extracted from existing plants and planted along the north edge of the village- this will help to control the erosion and stabilize the banks. It will also help fix the impurities that are currently present in the estuary due to sewage and solid waste disposal (Figure 9.3).

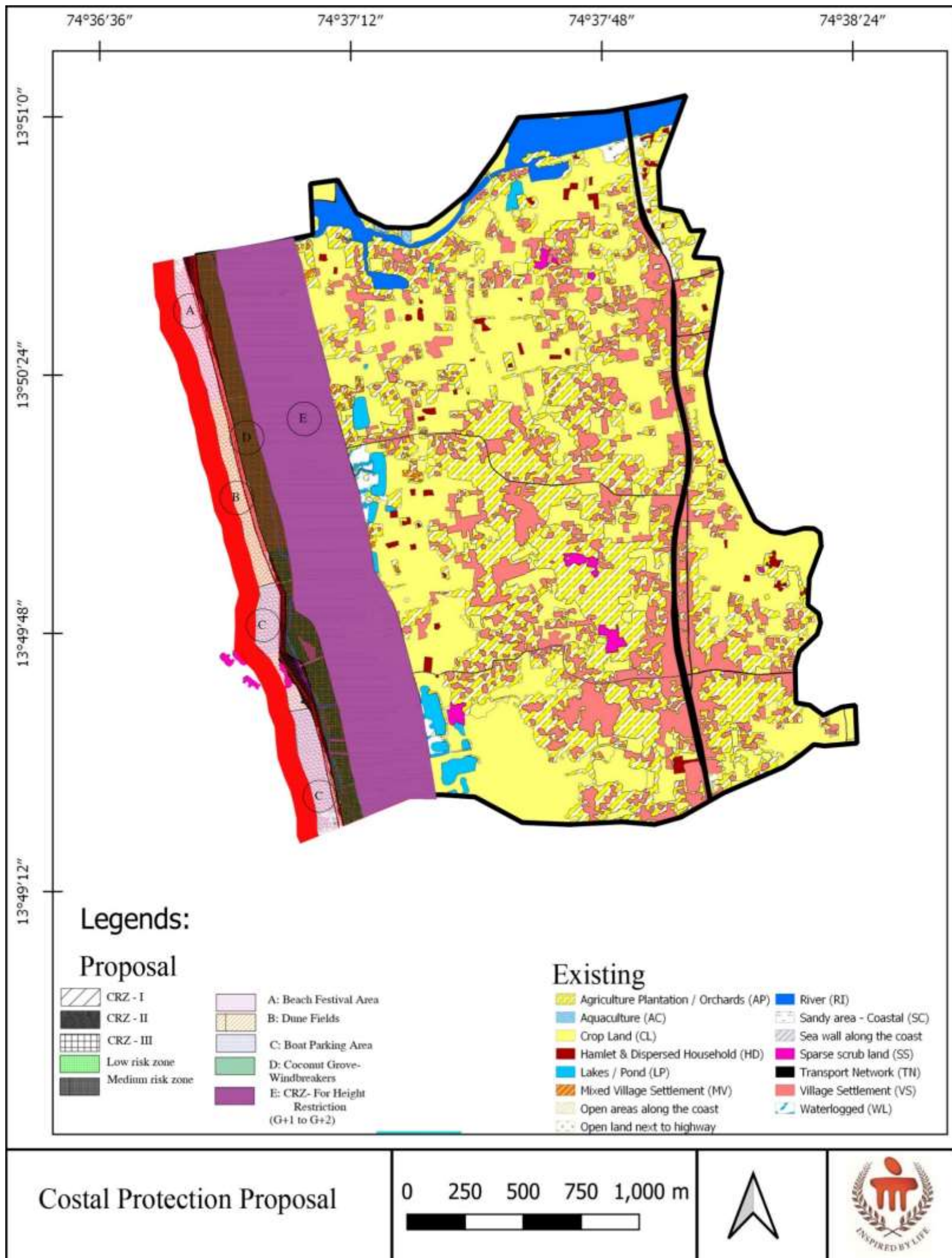


Figure 9-6 Proposal for Coastal Protection of Uppunda Village

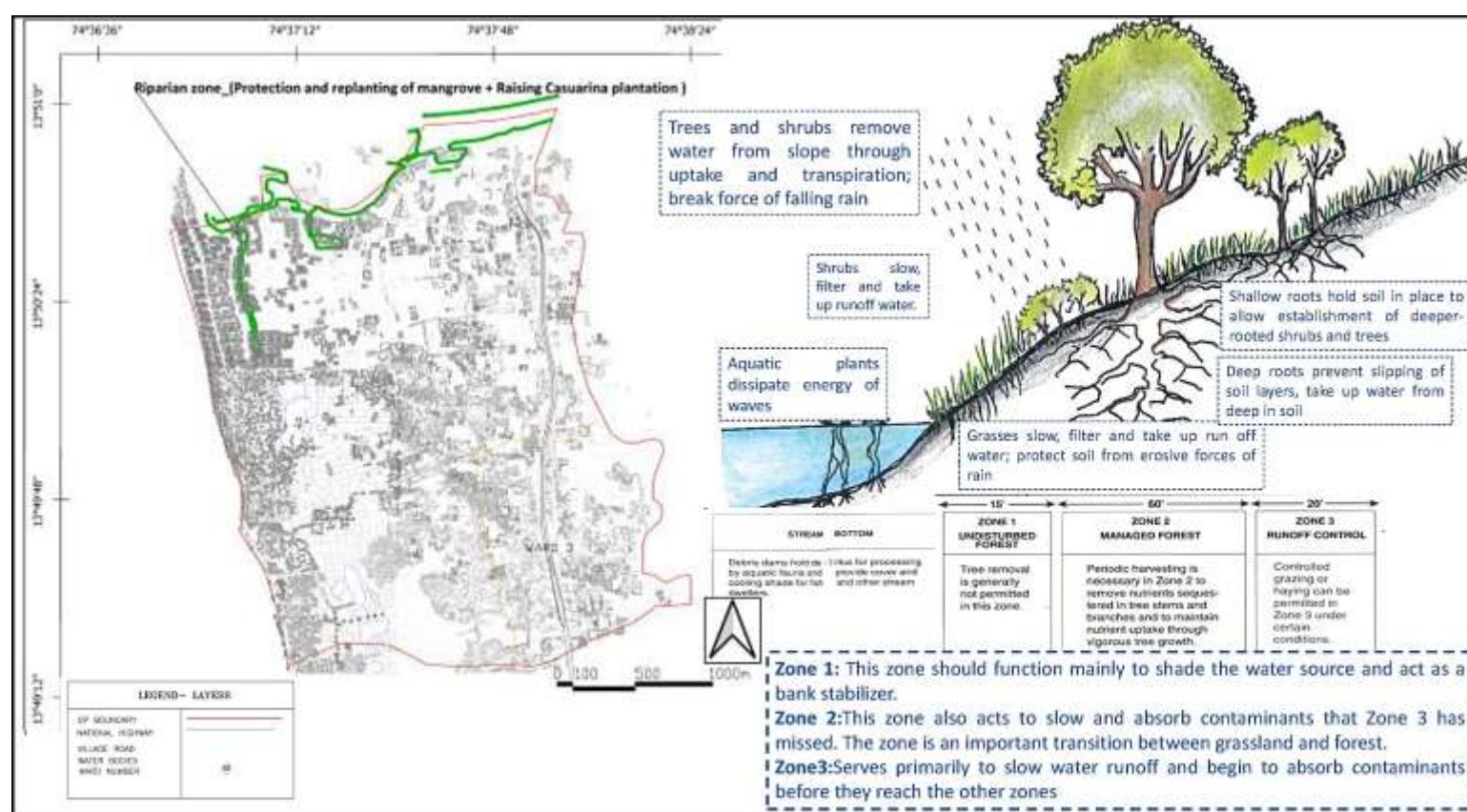


Figure 9-7 : Proposed and Existing Mangrove Vegetation through introducing Riparian zone in the site.

9.11.3.2 Zone system:

Zone1 will be used for planting just above the high tide line (prime sand-binders), for the level portion of the sandy beach, the ideal plants are creeping, salinity and desiccation tolerant perennial species such as *Spinifex littoreus*, *Ipomoea pes-caprae*, *Hydrophylaxmaritima*, *Launeasamentosa* and *Canavaliarosea*.

Zone2: Spreading herbs suitable for the mid-shore are *Glinusoppositifolius* and *Sesuviumportulacastrum*. Shrubs like *Scaveolataccada*. As heavy particles of sand carried by wind, these shrubs will help in deposition due to obstruction and gravity.

Zone3: Existing Coconut grove in these wards will act as windbreakers and barrier that visually communicates the start of the settlement. The deep roots will hold the sand in place.

Wind Speed in Uppunda: 14-22kph (average). For formation of dunes min. wind speed required: 16kph for heavy sand particles (Mascharenhas,2010)

Prevalent wind directions: South-west, North-west

Wave Height recorded in Uppunda: (update required)

Volume of Dune – l*b*h: 250x60x5m

Coastal Vegetation that can be used (refer to annexure for more options):

Fore-dune: *Spinifex littoreus*, *Ipomoea pes-caprae*, *Hydrophylaxmaritima*, *Launea sarmentosa* and *Cyperus arenarius*. **Mid-shore:** *Cassytha filiformis*, *Lippiano diflora*, *Canavalia rosea*, *Glinusoppositifolius*, *Sesuvium*, *Daturametel*, *Calotropisgigantea*, *Clerodendruminermis*, *Ixoracoccinea*

Hinterland/Inland: *Cocos nucifera*, *Thespesia populnea*, *Erythrina variegata*, *Pongamia pinnata*, *Morinda citrifolia*, *Zizyphus mauritiana*, *Casuarina equisetifolia* (Figure 9.7).

The Uppunda village comprehends under the coastal regulation zone and the shoreline is changed through the years. The demarcation of the high tide line and low tide can represent how far the coastal zone must restrict construction to not harm the lives of the people inhabiting. In accordance with the coastal zone maximum the stretch is maintained naturally with vegetation and other soft engineering technique the stretch can be easily protected. The sand dunes act as a shock absorbent for the high tides beyond which the dwelling units are protected.

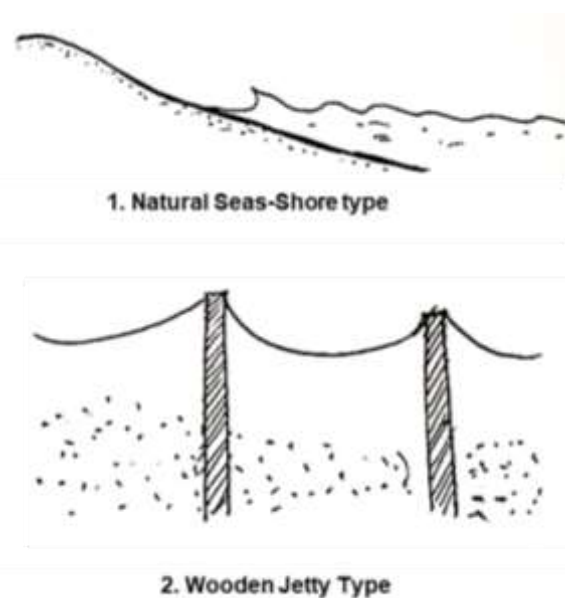


Figure 9-8 Existing Section AB at North-end of Uppunda's Coast- Madikal Beach



From the report (shetty, 2012) the many alternative for the shoreline protection is listed, among which the best suited as mentioned above, the natural seashore type is more efficient with the growth of the vegetation (Figure-9.10). The natural seashore type suits the natural environment, spaces the zone for aquatic system to build marine life growth. This type of shoreline also, helps in hampering the disastrous effect of the sea. This shoreline is more effective with the presence of the natural vegetative runner which stops the erosion of the soil as they are firmly rooted to the soil. CRZ divide the zones to three for protection up to 500m distance from the shore. The other type is wooden made jetty. The boat of this place is parked at the shoreline where there can exist sand dunes which might erode the soil layer. Instead when wooden jetties are placed, then the sides of them are utilized to tie up boat.

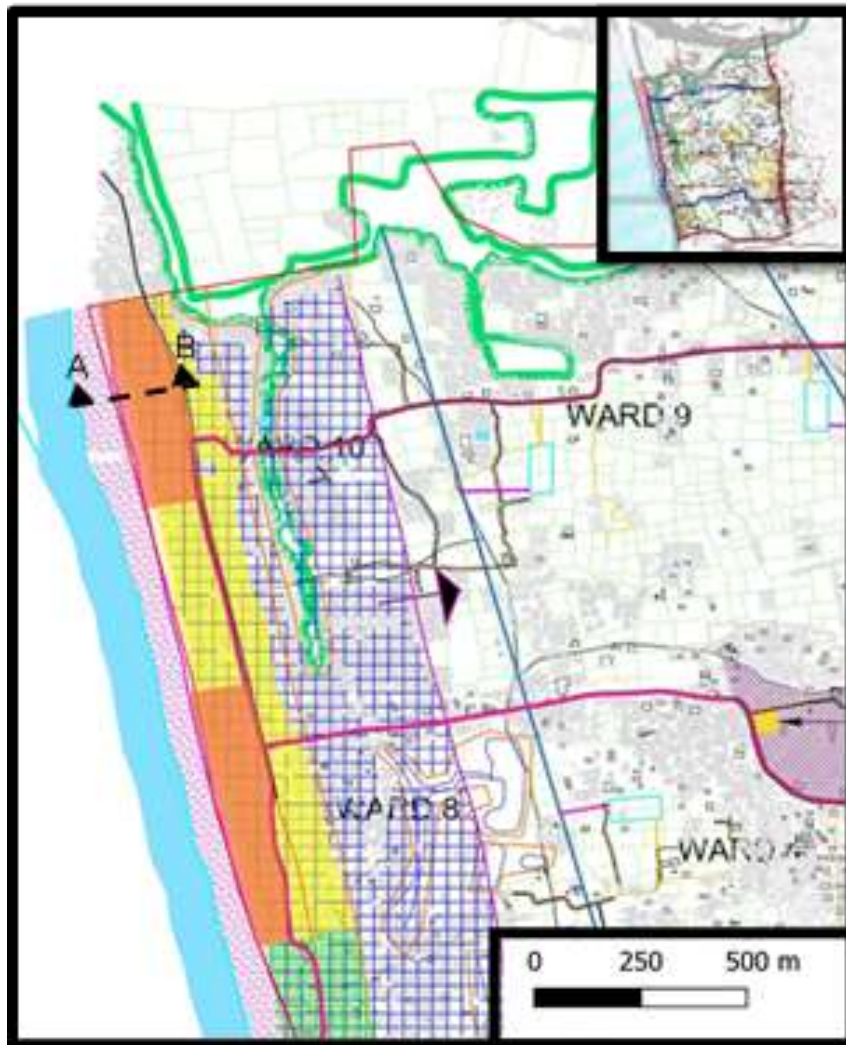


Figure 9-11 Map Showing Coastal Belt adjacent to Ward 10 and Ward 8

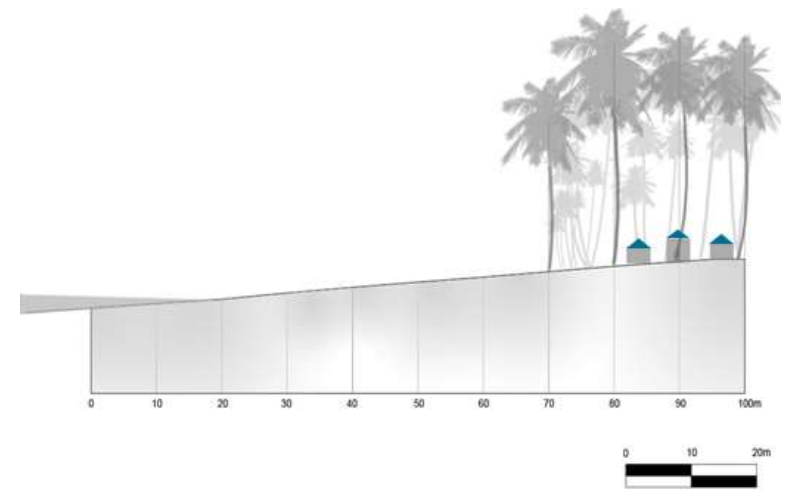


Figure 9-10 Shoreline Protection

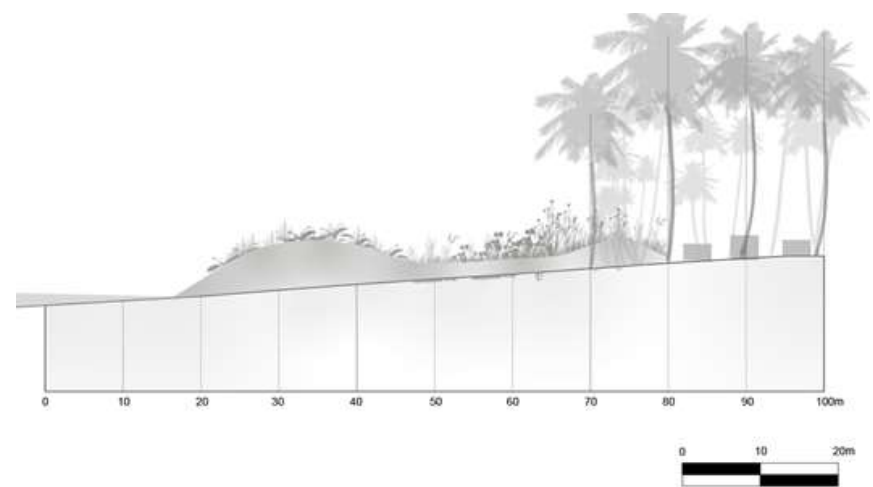


Figure 9-9 : Proposed Section AB at North-end of Uppunda's Coast-Madikal Beach

One Year: stable dune with sparse vegetation

Four years: dune established with thick vegetation

The functional parameter with respect to the natural seashore type and jetty type:

Table 9-1 Table showing functional parameters with respect to seashore type and jetty type

Functional parameters	Natural seashore type	Jetty type
Natural environment	Effective and suitable	Effective and suitable
Space for growth of marine life	Effective and suitable	Effective and suitable
Space for recreation activities	Effective and suitable	Effective and suitable
Land conservation	Moderately effective and suitable	Of very limited effectiveness/ not suitable
Sea water purification	Effective and suitable	Effective and suitable
Landscaping effects	Effective and suitable	Effective and suitable
Disaster control functions	Moderately effective and suitable	Moderately effective and suitable

From the table the shore alternative, that is, natural seashore type and jetty are distinguished. These types are also segregated with the help of the functional parameter to understand the type if will works with more efficacy, to know how it suits and is incorporated to the village.

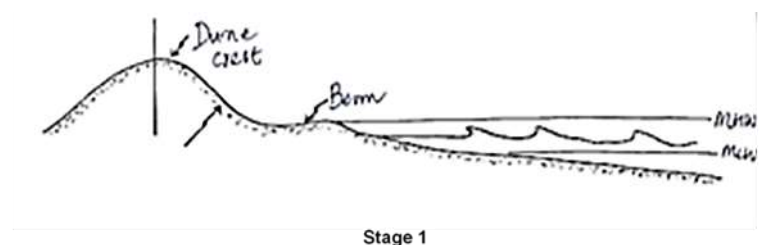
The sand dunes, when incorporated, visions how the shoreline differs before and after the storm. In figure 9.12 (a) the initial stage at which the normal wave hit and there was no change in the shoreline. As sand dune is proposed the after and before effect of the it upon having storm wave attack is noticed at 4 stages. The dune crest when hit by the storm gets eroded is seen in the figure 9.12 b) which makes the soil erode the dune and gets accretes to the lower part near the low tide line.

From the figure 9.12 the storm when struck the sand dune, the crest part of the dune is seen to be lowered at the shore. This not only accretes the soil down to the shore. This is a natural process of how the tidal wave act on the dune and soil get eroded from the dune crest.

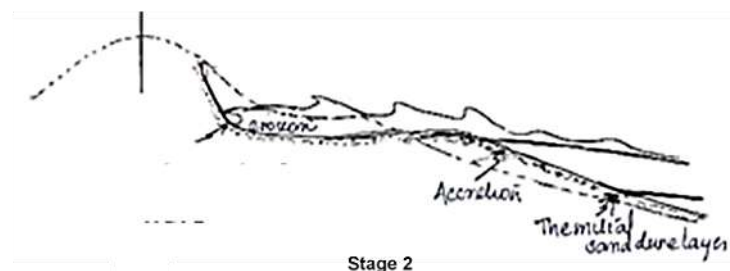
Here the plantation, that is, the runner holds deep in the soil which can reduce the soil to erode from the coastal line. The stage 4 also, depicts how the sand dune crest part of the shoreline is recessed. From stage 1 to 4 there is a huge difference of recession that happens in the coastal line.

As the sand dunes acts as a shock absorber the pressure from the high tide wave is absorbed by the sand dune and relatively the settlement that is near the shore gets less affected. This is why the shore line should not have any hard construction, as the pressure from the high tide wave reaches a longer distance if the coastline is hard the pressure of the hits the dwelling, habitation hard which can be dangerous for the people inhabiting near the coast zone within the high tide line.

As the dune is proposed on the shore, this is a cyclic process that happens during the storm attack, from stage 1 to 4, the soil erode and accretes which makes the dune to recess to utmost in the coast. There are few techniques that be strategized in Uppunda, as the coastal zone is highly populated the stretch needs to be retreated, that is, the dwelling units from the vulnerable coastline has to be shifted as of the sea level rise and high tide line of the shore. This stretch must be maintained as a no development zone else commercial activity can happen this will not risk the life of the people as the households of the people is shifted.

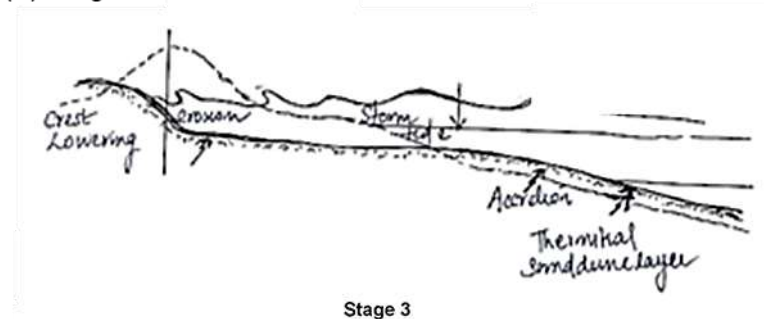


Stage 1

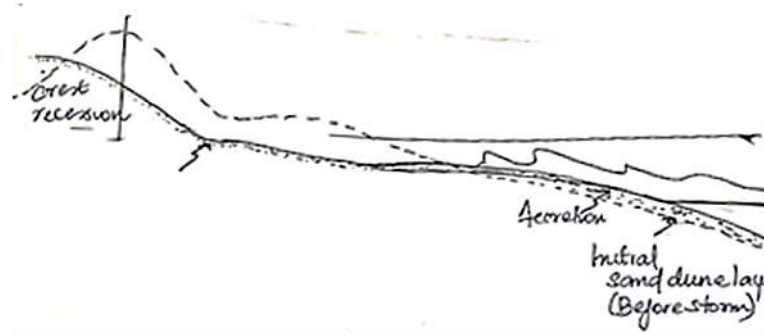


Stage 2

(a) Stage 1 – the normal waves when hit the sand dunes



Stage 3



Stage 4

(b) Stage 2 – The initial attack of storm wave

Figure 9-12 Stage 1 – the normal waves when hit the sand dunes
(b) Stage 2 – The initial attack of storm wave. Both the stage 3 and 4 depicts the lowering of the crest when the storm hit the sand dune,

source: (Nevis, 2001)

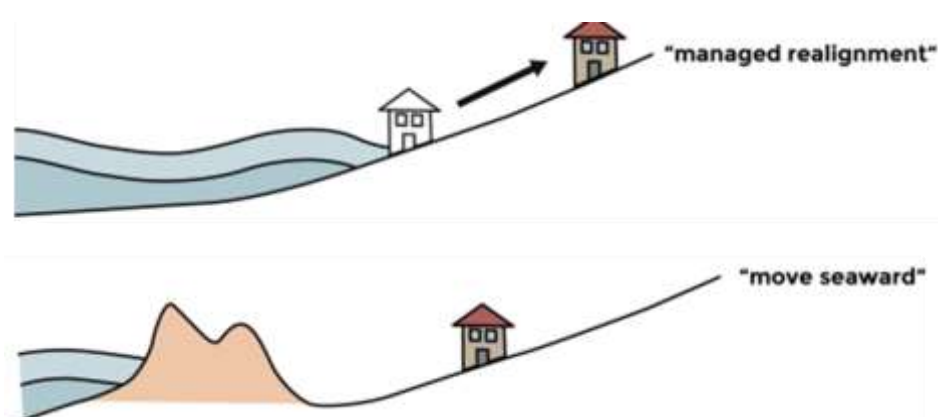


Figure 9-13 Technique for the shoreline, source: Geography, geographers – Swallow Hill community college.

The type 2 is advance in the line to safeguard the coastline soft engineering can be the best technique that can incorporated at the coast, that is, the sand dune formation. This method is done to make the dune to act as the shock



absorber while the tide hit the shore that is along the CRZ – III (rural coastal zone) (Figure- 9.13). Similarly, like mentioned above the planters such as Pandanus, Callophyllum inophyllum must be rooted, so that the erosion is addressed naturally.

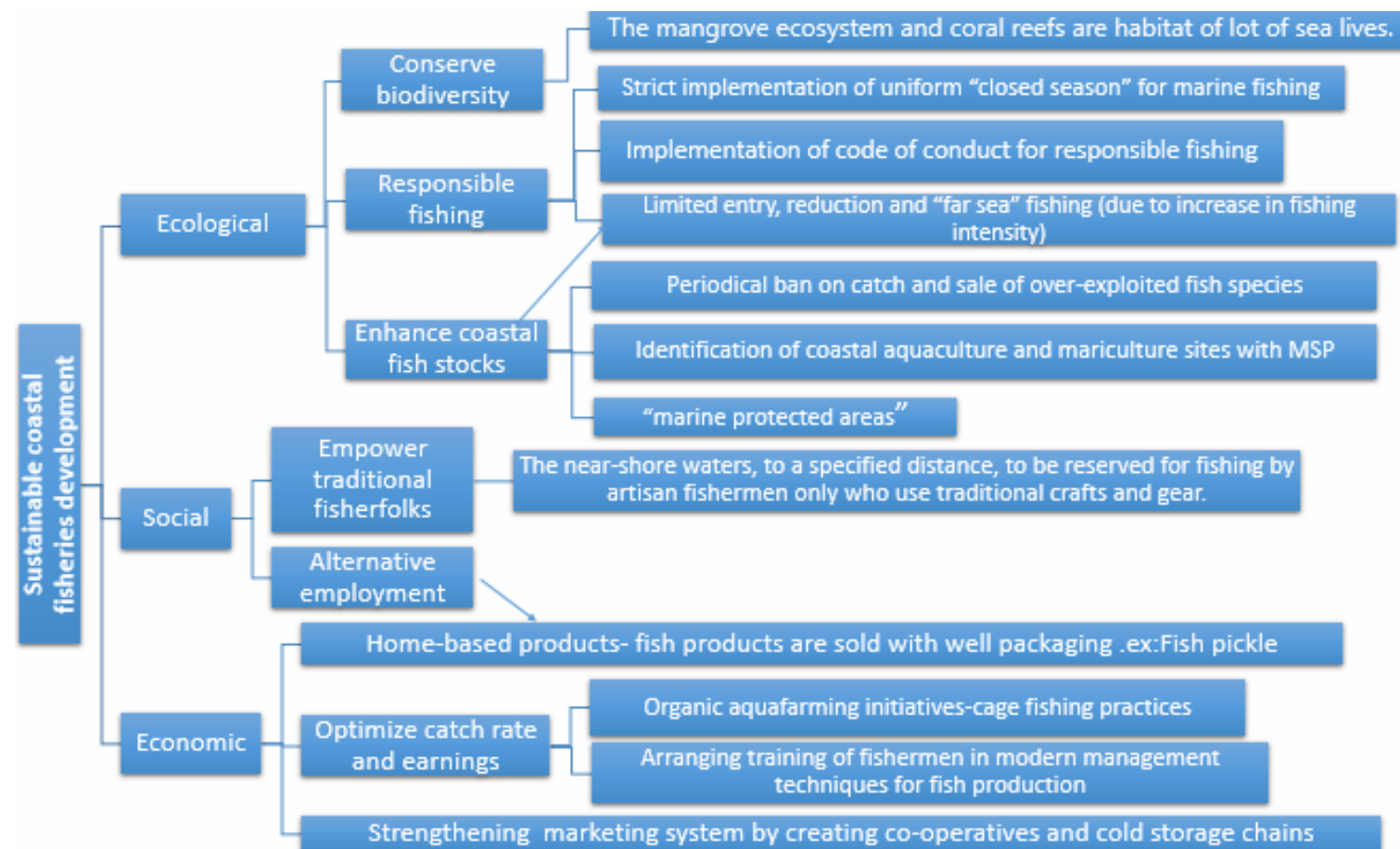


Figure 9-14 Key Objectives of Sustainable Fisheries Development. LiteratureSource: (Plan et al., 2012),(Possibilities, 2012),(Vivekanandan et al., 2003),(Dineshbabu et al., 2020)

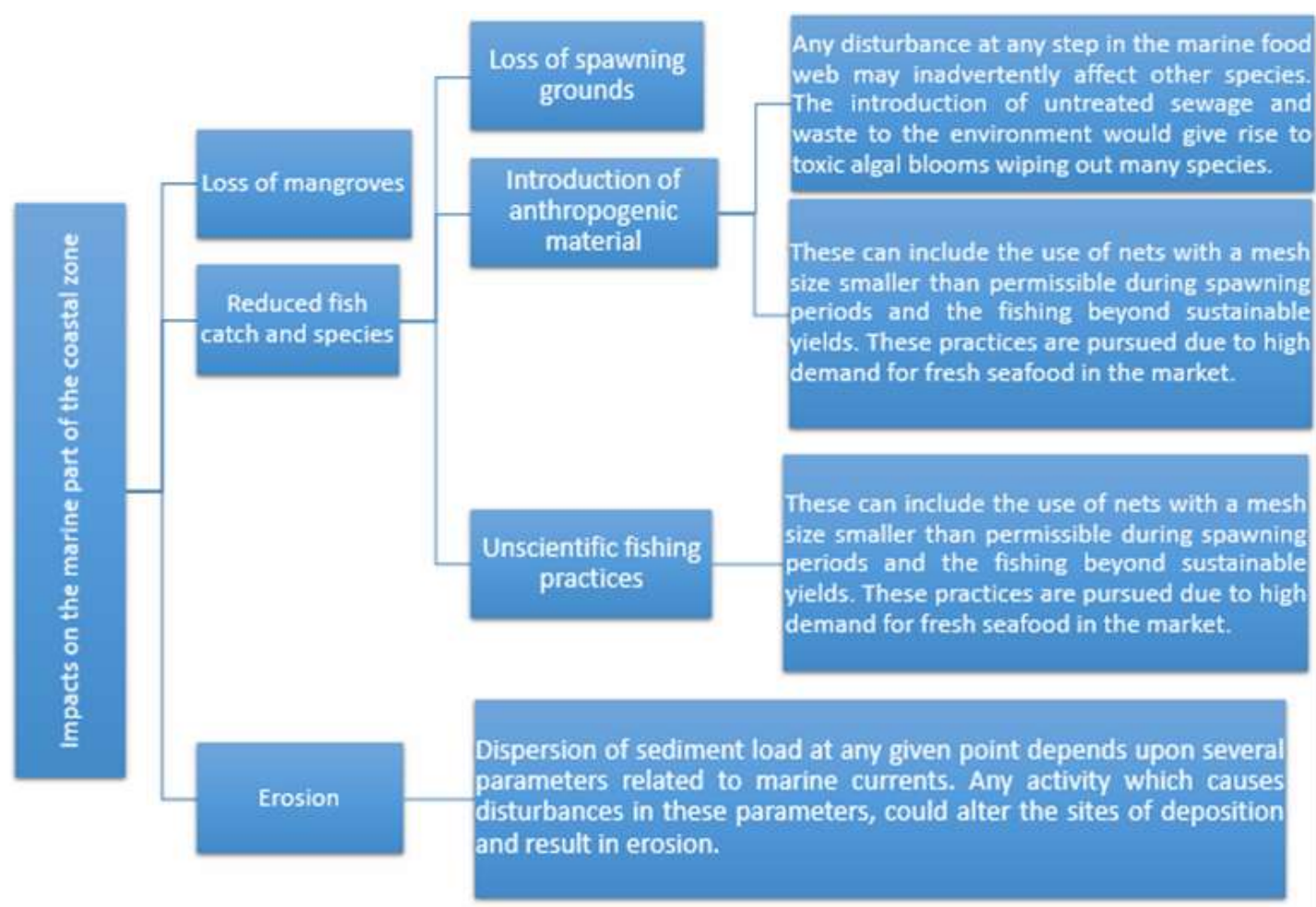


Figure 9-15 Technique for the shoreline, source: Geography, geographers – Swallow Hill community college.

9.12. Sustainable coastal fisheries development:

Fisheries production also plays a critical role in food security and livelihood in rural areas. The overall objective is sustainable coastal fisheries development to overcome the issues of reduction in marine fish production and safeguard the livelihood security of fisher folks.(Figure- 8.16).

- The overall objective of coastal fisheries management along the west coast of Uppunda is sustainable coastal fisheries development to Safeguard the livelihood security of fisher folks.
- This requires key ecological, social, economic and administrative issues to be addressed. (Figure- 9.14).
- Fisheries production also plays a critical role in food security and livelihood in rural areas.
- The conservation of the faunal resources will help in the sustainability of coastal fishery and thereby ensure livelihood of the coastal communities.
- The marine ecosystem bears significant impact on the long-term socio-economic resilience of the fisheries sector.
- Safeguarding the livelihood security of traditional fisher folks. (Figure- 9.15).

Key Points of proposal:

- 1)Riparian buffer zone.
- 2)To Identify coastal aquaculture and mariculture sites
- 3)Responsible fishing
- 4)Strengthening marketing system by creating co-operatives and cold storage chains

Goal being addressed:

- 1.Coastal protection.
- 2.Community development

9.12.1.Part-1: Proposal is conserving biodiversity:

- The coastal habitat and marine environment offers areas for reproduction, recruitment, feeding and shelter and should be protected
- Coral patches abound off the southern part of the southwest coast of India.
- These coral reefs exhibit rich biodiversity and provide nursery grounds for commercially important fishes.
- Mangrove forests have specific ecological role in the coastal ecosystem
- Mangroves serve as nursery for many species of finfish and shrimp.
- The estuaries maintain high levels of biological productivity and play important roles in:
 - (i) nutrient and organic material transport through tidal circulation,
 - (ii) nursery grounds for many species of shrimp and fish, and
 - (iii) breeding grounds for caridian prawns.

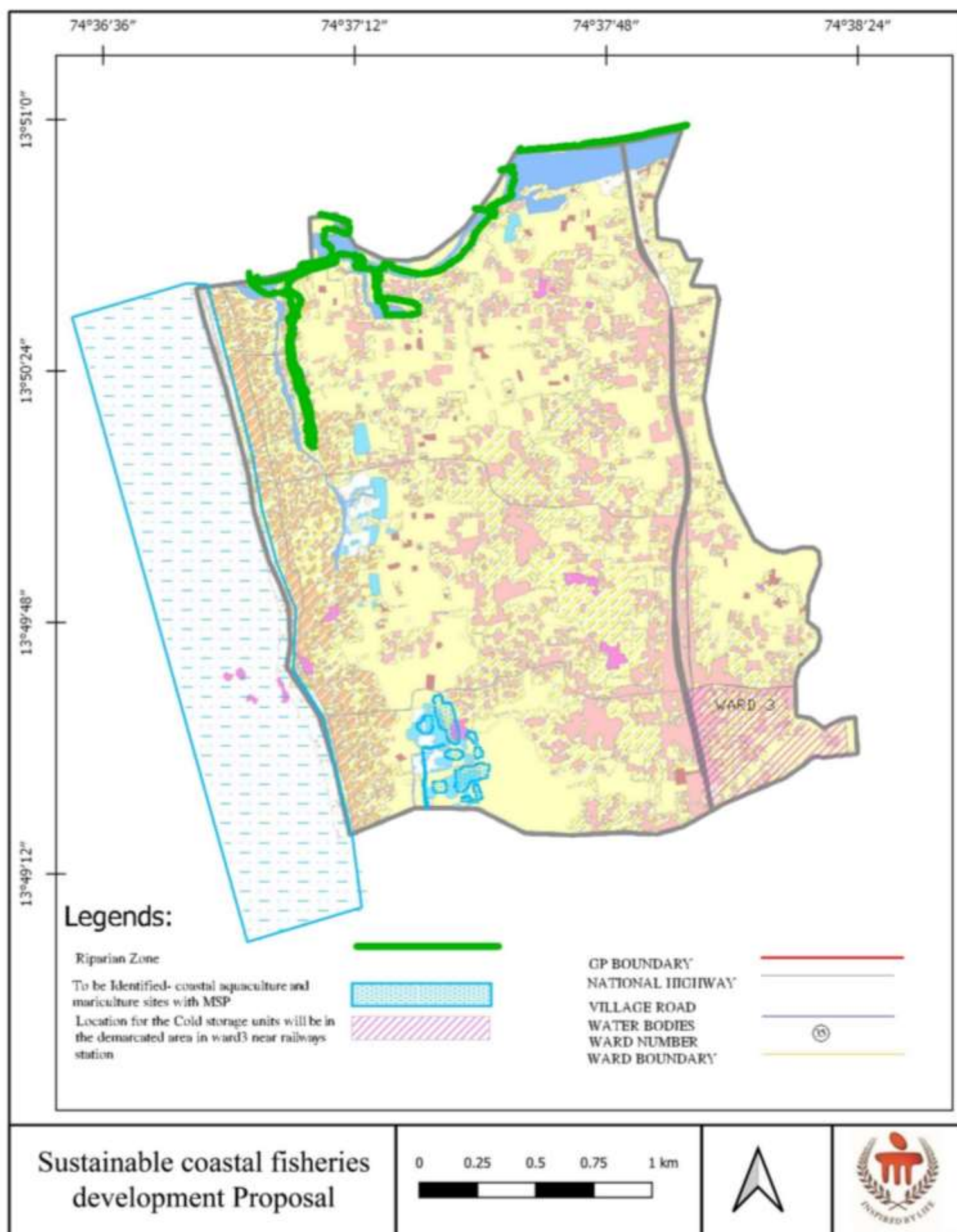


Figure 9-16 Proposal for sustainable coastal fisheries development for Uppunda Village.

Mangrove planting and protection

- Mangrove planting and protection Mangrove forests ('Kandla-vana') of the backwaters are considered high ranking productive ecosystem of the world. Yet most mangroves have been destroyed.
- Mangrove swamps are high ranking productive ecosystems.
- Mangrove areas are rich in fisheries and act as nurseries for juveniles of fish, prawns, shellfish and crabs.
- The mangroves shelter coastal water birds and enrich the waters with nutrients.
- Mangroves can protect coastal river banks from erosion, rivers from flooding.
- Coastal panchayats be allowed funds for mangrove planting Incentives to be given to village Self-Help Groups and other village level organizations for raising and maintaining mangrove forests.
- Incentives to be given to panchayats and other local bodies, village self-help groups and cooperatives of estuarine farmers for raising and maintaining mangrove forests.
- The services of estuarine farmers like the Patgars to be taken for raising mangroves in the backwaters. Involve traditional fishermen of backwater villages, whose livelihoods have been affected by commercial shrimp farming, in mangrove regeneration and protection.
- Top priority to be given for raising mangroves by the Forest Department Scheme to be prepared for rehabilitation of abandoned prawn farms with mangroves so that their ecology is restored and they are made suitable for natural method of fish farming and raising of Kappa rice.
- Scheme to be evolved for planting potential mangrove areas and degraded mangrove areas within CRZ to be planted with mangroves. The scheme to cover both private and state owned lands.

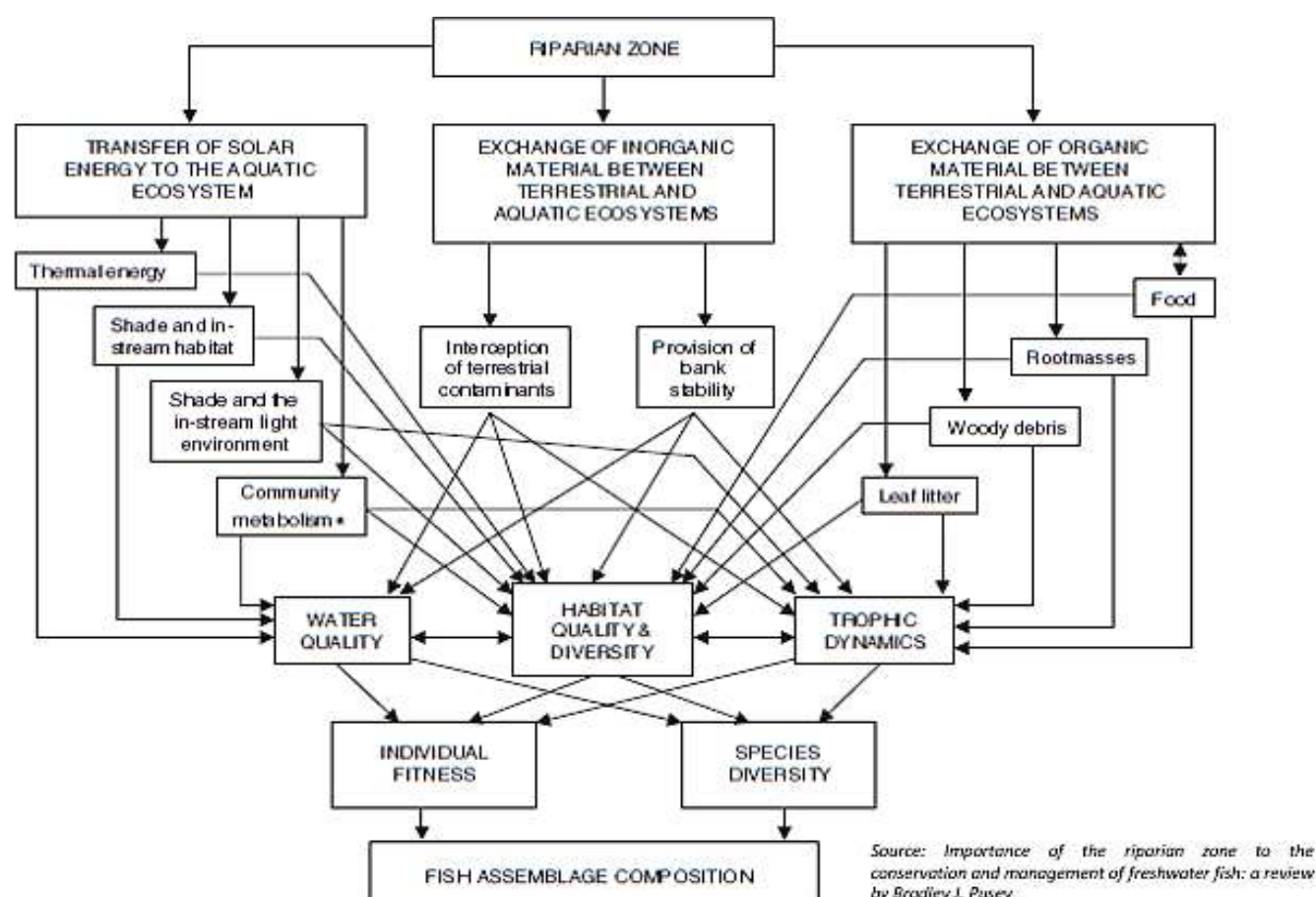


Figure 9-17 Conceptual model depicting the mechanisms by which riparian regulation of energy

Riparian zone:

- By acting as buffers between upland areas and open water, they help filter pollutants such as nutrients and sediment. Healthy riparian vegetation helps to reduce stream bank erosion and maintain stable stream channel geomorphology.
- Vegetation also provides shade, which works to lower water temperatures. They include the floodplain as well as the riparian buffers adjacent to the floodplain.
- A riparian buffer is usually split into three different zones, each having its own specific purpose for filtering runoff and interacting with the adjacent aquatic system. Buffer design is a key element in the effectiveness of the buffer.
- It is generally recommended that native species be chosen to plant in these three zones, with the general width of the buffer being 50 feet (15 m) on each side of the stream.

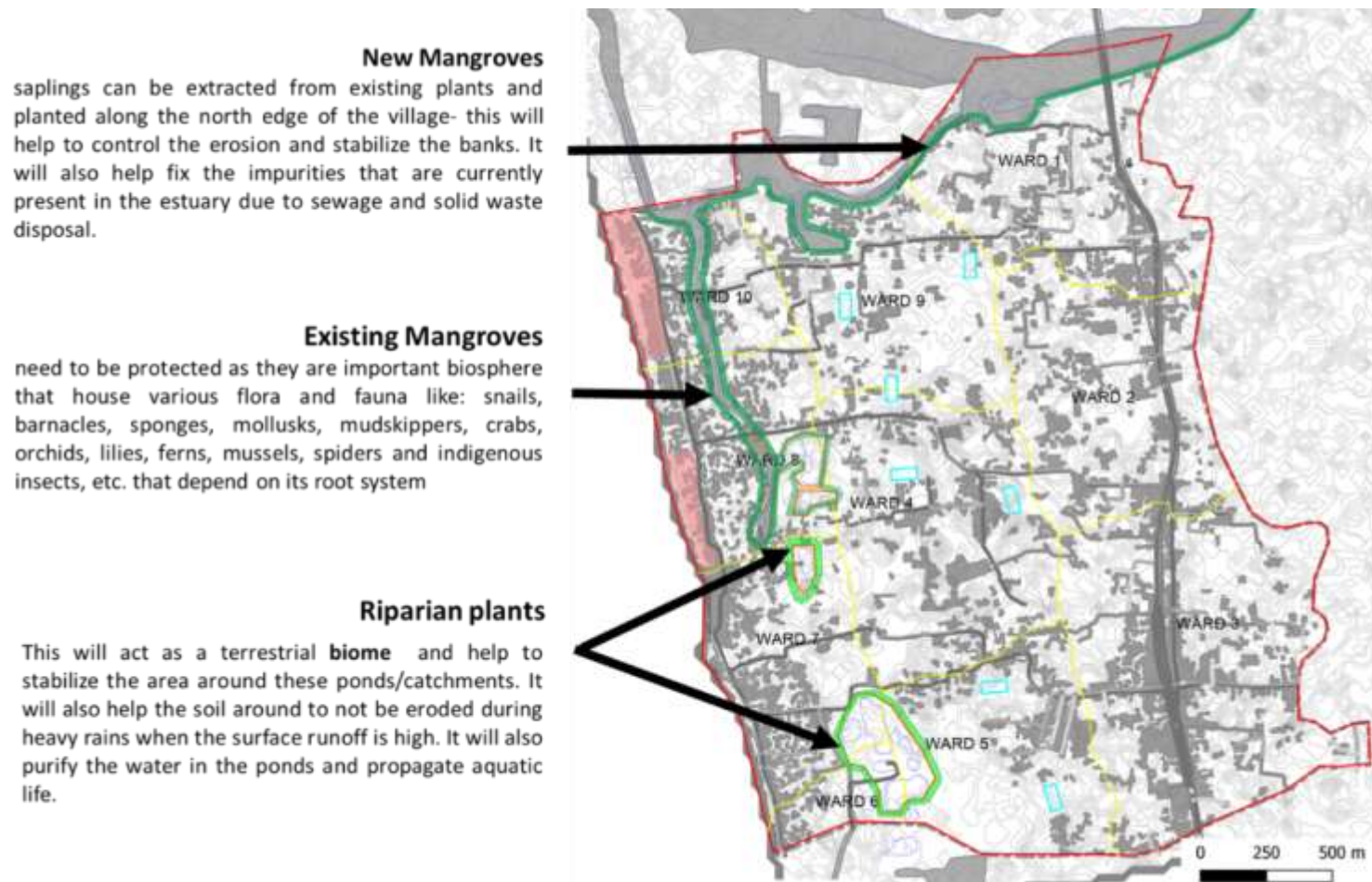


Figure 9-18 location of mangroves and riparian zone.

Part-2: Proposal for Identified coastal aquaculture and Mari culture sites with MSP:

Area demarcated in green colour is the Identified coastal aquaculture and mariculture sites with MSP (Aquaculture zonation of Sumana-Byndoor Estuary was carried during 2014 and 2015.) and Area demarcated in yellow is the to be Identified- coastal aquaculture and mariculture sites with MSP.

One of the options to tide over the situation of reduction of marine fish production is regional level planning to increase fish production from available water resources. Therefore, it is essential to have an integrated spatial planning of the available water resources as it has multiple uses. So Marine spatial planning (MSP) and aquaculture zoning. The conversion of mangroves for aquaculture is detrimental as the shrimp fry (baby shrimp) availability decreases, as the mangroves are the natural wild fry collection habitats.

So based on the data collected from the literature study the zones marked in yellow are the possible demarcations of the sites Identified for coastal aquaculture and mariculture sites. .(Figure- 9.19).



Figure 9-19 zones marked in yellow are the possible demarcations of the sites Identified for coastal aquaculture and mariculture sites

Part-3: Proposal for Responsible fishing:

- I. Safeguarding the livelihood security of the artisan fisheries:(Ramachandran & Sunil Mohamed, 2015)(Plan et al., 2012)(Gadgil et al., n.d.)
 - The near-shore waters, to a specified distance, to be reserved for fishing by artisan fishermen only, who use Rampani nets, caste nets, hooks, canoes and other non- mechanized crafts.
 - The artisan fishermen may be exempted from the fishing ban imposed during the monsoon season. The Coast Guard may be deployed to carry out such regulations.
 - Introduction of limited entry and effort reduction schemes, together with promotion of fishing in deeper, “far sea” areas to reduce increasing fishing intensity
 - Panchayat-wise yards for preparing dry fish.
 - Promotion of fisher-women's co-operatives is very essential.

II. Promoting sustainable utilization of marine/estuarine fish(Ramachandran & Sunil Mohamed, 2015)(Plan et al., 2012)(Gadgil et al., n.d.)

- Educate fishermen on the pollution likely to be caused on account of throwing away of unwanted fishes both in deep sea and coastal waters and also about oil spills and the need to prevent such actions, fishermen are required to be educated suitably in their regard.
- Construction of sea wall affects breeding of fishes. Formation of natural sandy coast (French Technology) could be thought of for the protection. This would also provide breeding ground for coastal fishes.
- Priority to be given for Protection of ecology of seashores by raising vegetation and sand dunes.
- Raising economically important plants such as Honne (*Calophyllum inophyllum*), Honge (*Pongamia pinnata*), Ketike (*Pandanus*) and medicinal plants etc. can strengthen livelihoods of coastal poor.
- Strict implementation of uniform “closed season” for marine fishing for the entire west coast, from 10 June to 15 August is expected to protect the brood stock of fishes from exploitation by the mechanized sector (to protect brood stock of fishes to facilitate breeding and recruitment of their stock). There is a ban period of 2 months -June 10 to August 15 for fishing. However, there has been a trend of excessive fishing just after the ban period which over the time decreases gradually.
- To impose mesh regulations for the fishing gears in operation in the coast to prevent catching of young (non-target species) and juvenile fishes.
- Licenses for additions to the fleet of purse-seines and trawlers should be limited to sustainable limits Soft loans for fisheries sector be limited to traditional fishing communities only so as to safeguard the fish stocks from over-exploitation by outside commercial sector.
- No collaborative ventures for the bottom trawling, very destructive to marine ecosystems, be permitted in Indian territorial waters. Use of large trawl nets to be regulated to minimize incidental catches and other damages to the sea bottom ecosystems.
- Priority steps to be taken to identify fish breeding grounds and other sensitive areas and such areas be declared as “Marine Protected Areas”.
- CRZ regulations do state fish breeding areas mangroves are to be treated as CRZ I. In practice no such areas are identified.
- Periodical ban on catch and sale of over-exploited fish species to be implemented.
- Development and support for fishery by developing existing (organic aquafarming initiatives-cage fishing practices) and alternative culture systems that is safe and provides good economic returns.

Restrictions on prawn catching during breeding period *Paeneus indicus* —white shrimp- breeds during December to May, *P. monodon* —tiger prawn- breeds during May to October, in bar mouths, estuaries and backwaters. A ban on catching of the above species during the breeding periods has to be recommended.

Part-4: Proposal for Strengthening marketing system by creating cold storage chains:

Benefits of development of cold chain infrastructure

- To improve the nutritional status and food security by augmenting national fish production.
- To minimize post-harvest losses, improve quality and safety of fish products to acceptable standards.
- Improvements in fish preservation facilities to make the fish available almost round the year.
- To increase foreign exchange earnings from fish products. To develop high profit margins to the producers.

The Proposals for Coastal protection and development of fisheries activities in shown in Figure- 8.21.

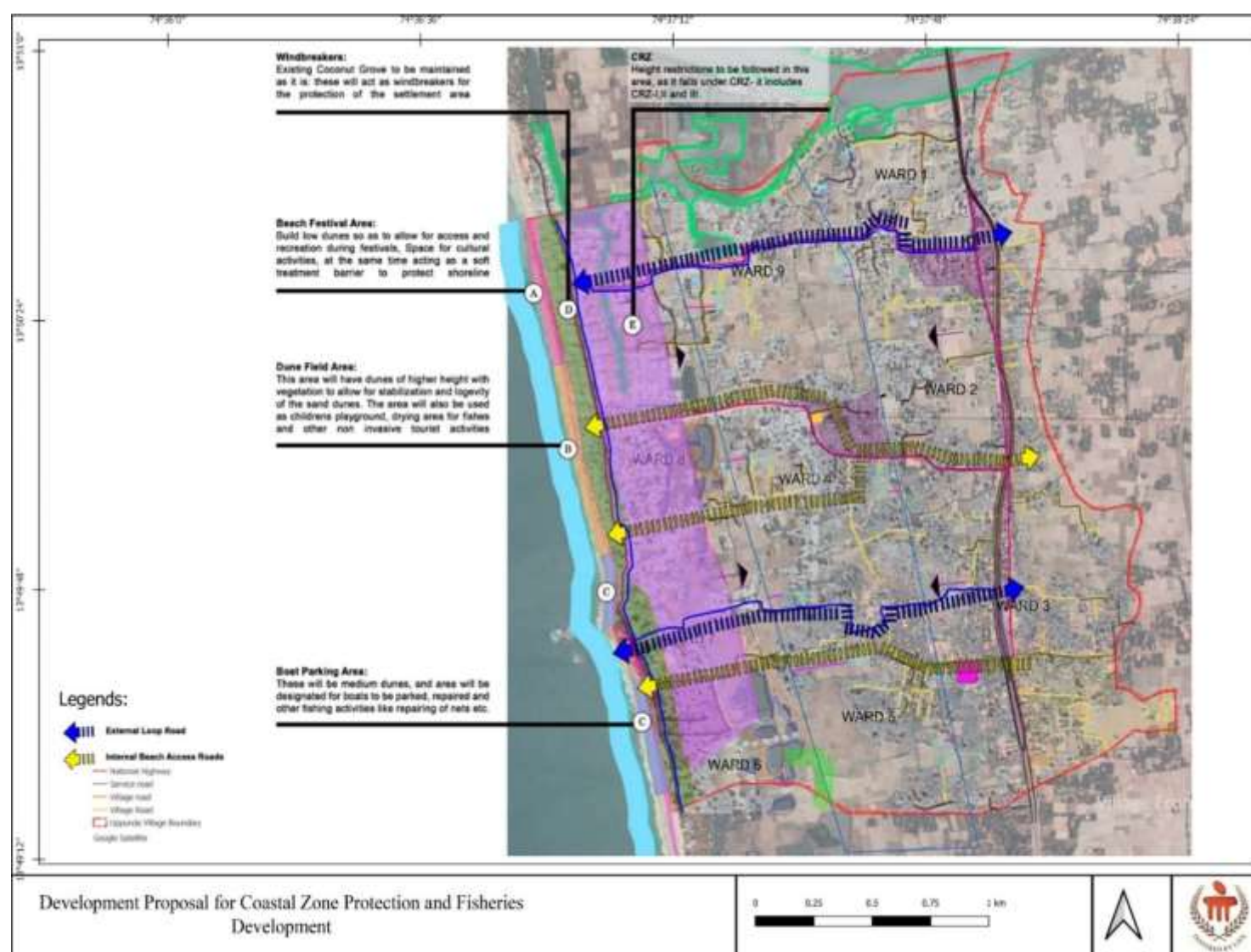


Figure 9-20 Development Proposal for Coastal Zone Protection (Identifying Dune field area, Beach festival areas, boat Parking areas and CRZ designated zones) with Fisheries Development

9.13. Proposal for Enhancing Neighborhood level development for Uppunda Village.

The village Uppunda has ten wards spread around on an area of 530.6 hectares. The neighborhood development planning in the village Uppunda is related with the culture, lifestyle and temples in the village, as the village is rich with temples and other public spaces. Also, the neighborhood development planning in the village is focusing on initiating the existing potential of the villagers by making use of available resources wisely. Along with that the sense of unity and feeling of belongingness is more in village area which should be considered as a major strength to do neighborhood planning. The proper neighborhood planning will enhance the cultural identity, food security and safety of the communities living in Uppunda. The planning process is catering towards the importance of its unique location, cultural and economic values, the needs of local society and natural ecosystem.

(Figure- 9.22).

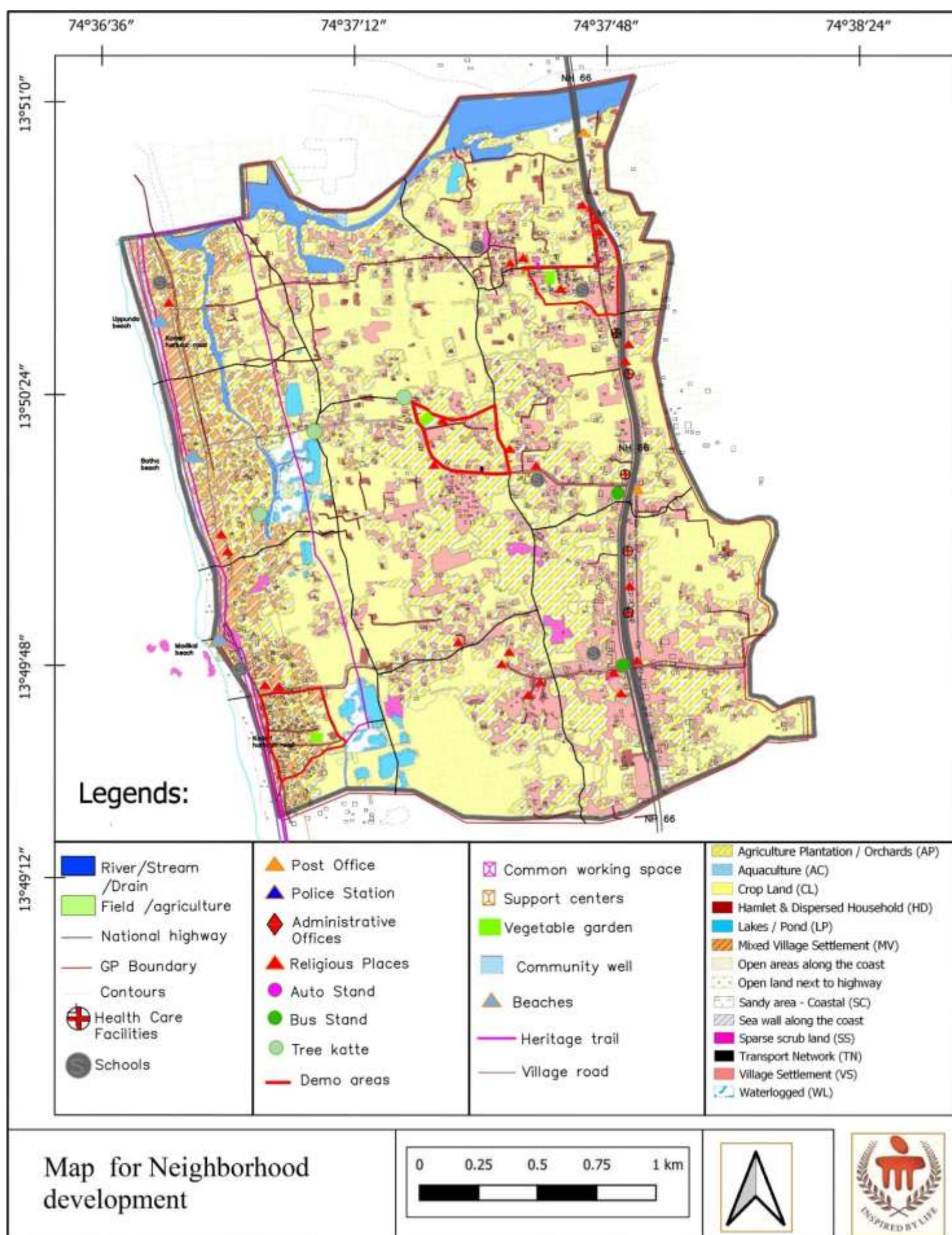


Figure 9-21 Proposal for Neighborhood development in Uppunda Village



Neighborhood planning helps in inhabitants within the territory who will be having similar interest to find a smart and sustainable way of living. Coastal areas of Uppunda have traditional fishing and cultural communities, so the neighborhood planning in the village aims to build up an integrated approach to increase the social interaction among various community. This framework also helps in achieving not only sustainable development but also natural and heritage conservation. Local community life in the coastal areas is strongly dependent on the seasonal migration of the inhabitants, tourism, the existing biodiversity and ecosystem, climate changes, recreation, work opportunities, and natural sea and water resources. So, the neighbourhood planning and development in such coastal village should consider all the aspects which mentioned above.

Aim of the proposal: To enhance the cultural identity and safety between the people living in the Uppunda village through developing the neighbourhood planning.

Objectives

- To improve the interaction between the people living in the neighbourhood level.
- To enhance the existing potential of the villagers whereby tackling the issues of food security, lack of good drinking water and lack of awareness etc.
- To protect the natural and heritage assets in the village.
- To promote a sustainable way of living for the villagers.

9.13.1.Delineation of the demo areas of rescue zone cum community support centre and justification

The neighborhood development planning process involves first the delineation of demo areas in the village. Three demo areas is taken the village from Ward 2, Ward 4 and Ward 7. The delineation is done on the basis of selecting areas from the wards near the coastal area, wads near to the National highway and one area in the wards between the wards in coastal area and near National highway. There are four wards near the coastline. They are Ward 6, 7, 8 and 10. The first demo area

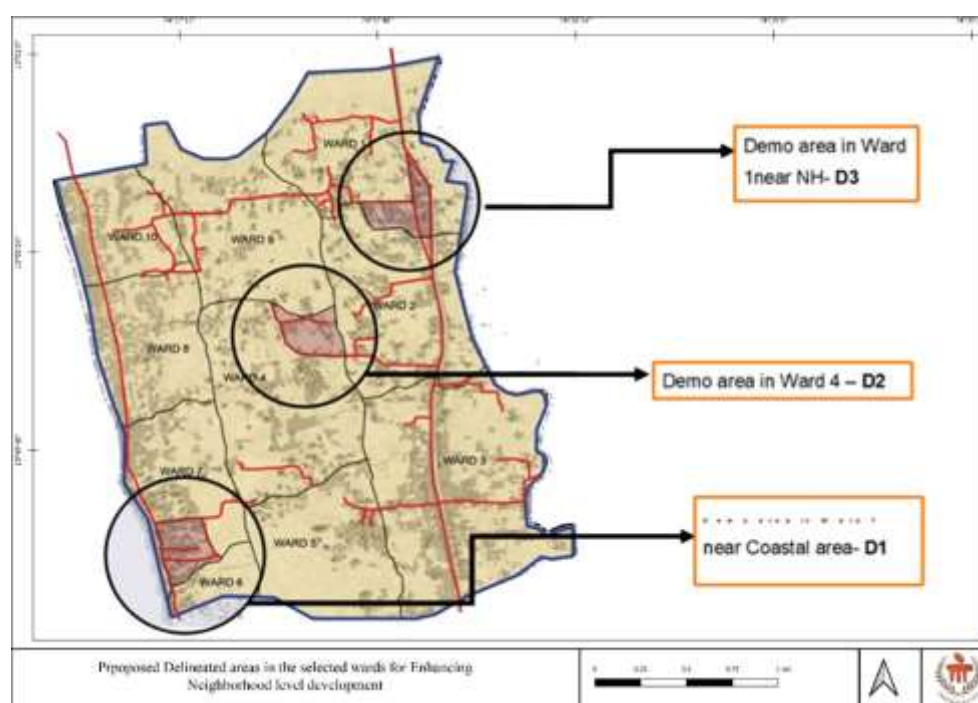


Figure 9-22 the map of Uppunda village with the delineated areas in the selected wards

D1 is taken near the coastline in Ward 7. This ward has high population density with dense cluster of housing when compared to the other wards near the coastline. Another major issue faced by the villagers in Ward 7 is waste dumping in empty plots, water entering in the houses at the time of flood and rainy season and dilapidated condition of houses. The second demo area D2 is taken in between the wards between the coastline wards and wards near the NH. The wards are ward 4, 5 and 9 and from area in the ward 4 is taken. When compared to these three wards, ward 4 have high dense housing and the it is close to National highway, located in the center part of the village. The ward also faces the issue of open waste dumping. No waste disposal or collection by the panchayat or municipality for this ward and no alternate source of water when wells dries up during summer season. The third area is D3 in Ward 1 and the area is close to Durga Parameshwari temple which is the prominent temple in the village. Open waste dumping and compost of waste are the other issues seen in this ward. The three delineated area is approximately 1,00000 sq.km. Ward 4, 5 and 9 is approximately 1 km away from the National highway and ward 6, 7 ,8 and 10 are near to the coastline which is 100 metres from the shoreline (Figure-23).

9.13.2. Community Wells

Community wells are shared wells used by a cluster of people within a neighborhood for domestic as well as for irrigation purpose. Community wells not only tackle the issue of drinking water shortages but it is a very effective place to improve the interaction within the communities. The proposed Community wells in Uppunda can act as a place for social interaction within the neighborhood and also creates a sense of unity between the people (Figure 8.24).



The map (Figure-8.26) represents the position of community wells that is possible in the selected demo areas which is overlayed with contour map with the settlement pattern. This with respect to the natural contour low lying points are demarcated. The selected points which tends to D1 is - 83, D2 is -76 and D3 is -76 are the possible lowest points in each delineated demo area. So, the community level tanks are spaced in these here. Due to salinity issue large shallow community tank can be provided in the community level. So this can be act as a common point of water collection for various domestic purposes and act as a point of interaction. (Figure 8.25).



Figure 8.25: Conceptual sketch of Community well which is acting as a social interaction place.

Calculation of capacity and size of community well

- Water required per person for domestic purpose - 100 litre per person (WHO standards)
- No. of house hold in the demo area - 65 household
- Total amount of water required per household - $4 \times 100 = 400$ L (considering 4 members per household)
- Total amount of water required in the demo area- $400 \times 65 = 26000$ L
- Amount of water required for vegetable garden per sq.m = 20 L
- Total amount of water required per day in vegetable garden – $1040 \times 20 = 20,800$ L
- Total water required – $26000 + 20800 = 46,800$ L
- Tank dimension can be 3m x 4m x 5m

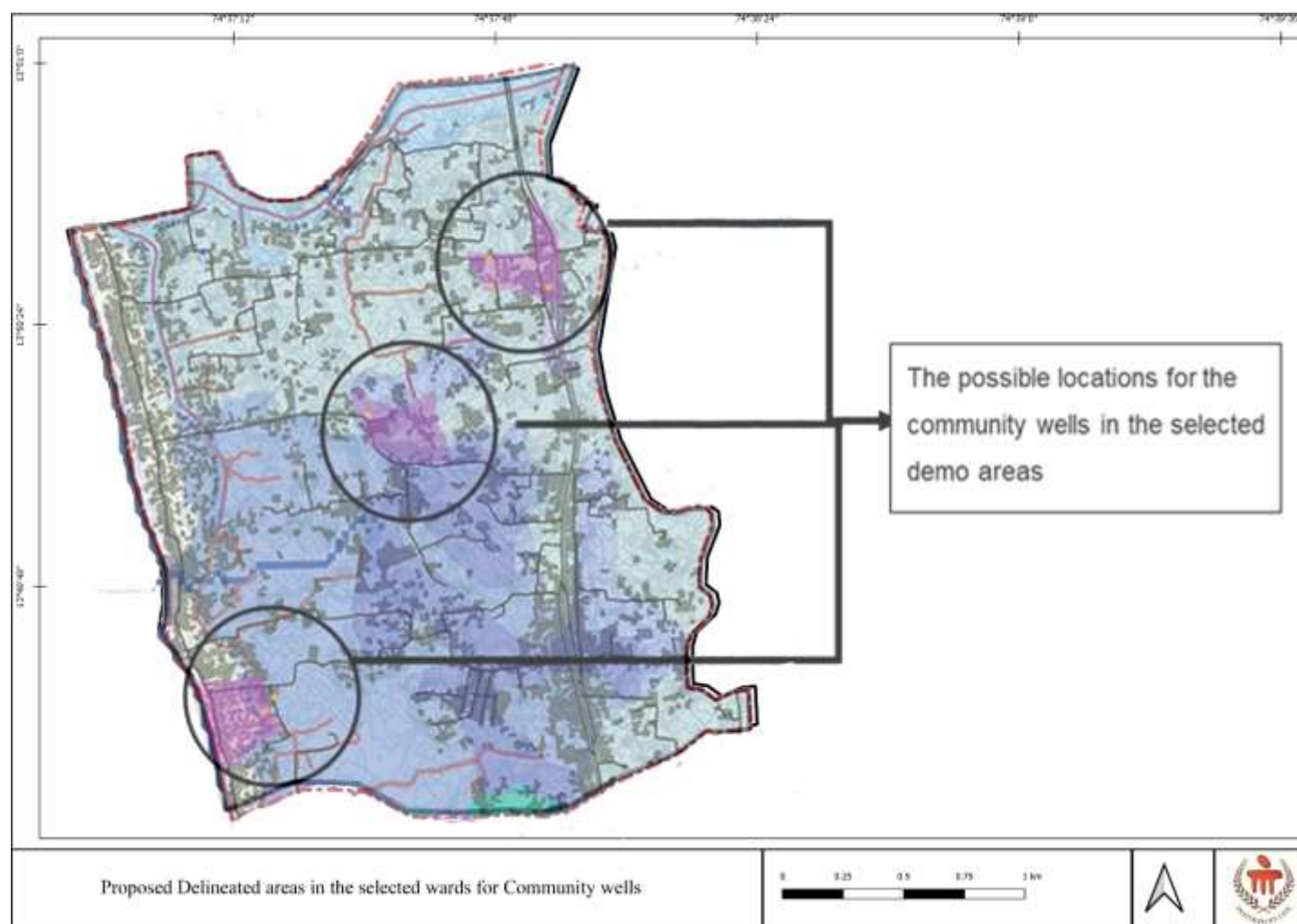


Figure 9-23 Map showing the possible location for community wells



Recommendations and strategies:

- These well position should be placed far from the toilets (septic tanks) of the household so that the grey water mix (because of the characteristic of the soil) does not happen (Figure 9.27).
- The structure of the support centre should follow the CRZ guideline and the material usage should be locally available materials.
- Dumping at empty plots and throwing waste in river should be strictly restricted by the panchayat along with waste segregation and collection points at the household, neighborhood level.
- According to Garbin-Herberg relation, 1:40 ratio, ground water pumping should be avoided, to reduce salinity in the water

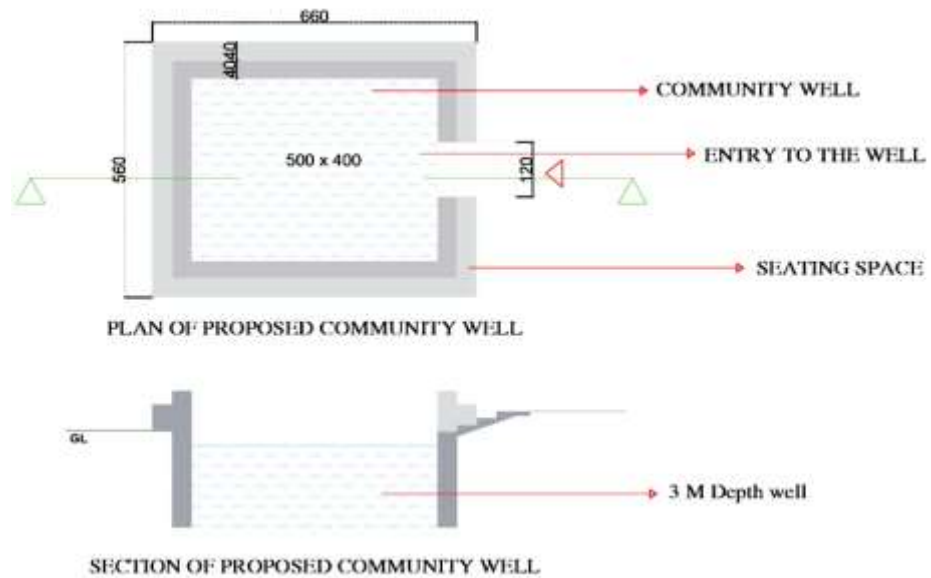


Figure 9-24 prototype of community well

9.13.3. Neighborhood level Vegetable garden

Neighbourhood level vegetable garden acts as again an interaction space for the villagers in neighbourhood and improves teamwork. It enhances food security during off-season and enhance women participation which further generates income. Considering the climatic conditions of Uppunda salt tolerant vegetable can be chosen according to the site conditions. E.g.- Tomato, beet, Spinach, Cabbage etc. Also community level vegetable garden can improve safe and hygienic neighbourhood which also provides fresh food and improves community health. (Figure- 8.28).



Figure 9-25 conceptual sketch of vegetable garden.

Calculation of capacity and size of vegetable garden

- Dimension of 1 row in vegetable garden = 1.2 m x 3.3 m (11ft x 4 ft), No. of rows required per house hold - 4 rows
- Total row required in vegetable garden = 4 x 65 = 260, Area of one row – 4 m sq, Total cultivable area - 1040 sq m
- Circulation space - 0.8 m, Total area of the garden including circulation space - 2217 sq.mt.

9.13.4. Proposal for Neighborhood level common working space for Uppunda Village.

Neighbourhood level common working space promotes all age group participation in a single place. It helps to exchange ideas and improves coordination within the neighbours. It also helps in forming small partnership for household industries and in turn helps in increasing the productivity. This is a good method to improves cultural identity and safety within the community. (Figure- 9.29)

9.13.5.Support center

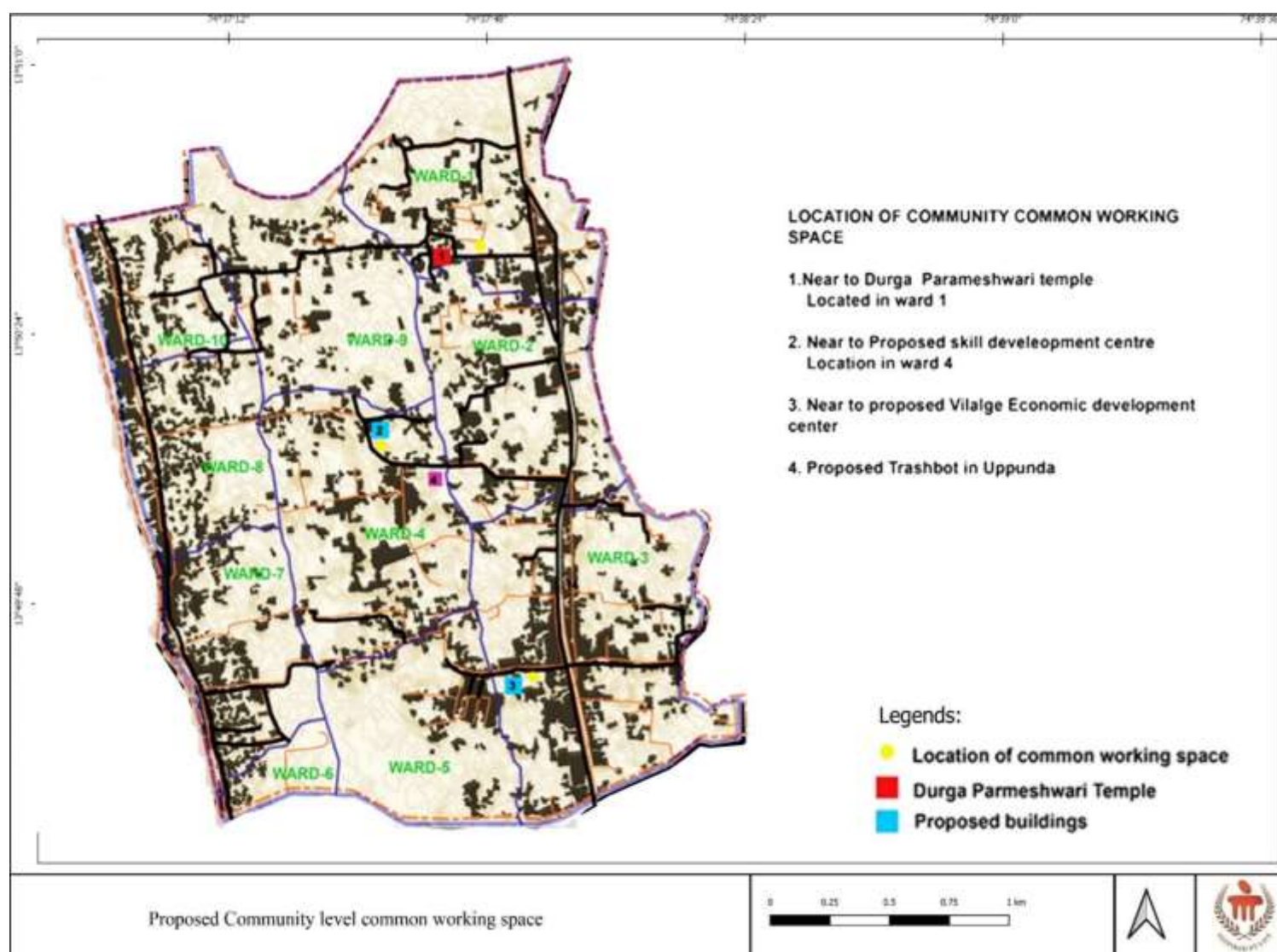


Figure 9-26 Poposed sites for community support centre

Table 9-2 Table showing the details of Services in Support Centre

Sl.no	Services in support centres	Details
1	Information centre	<ul style="list-style-type: none"> Providing interactive display screens showing awareness to the history and culture of the village, existing schemes and policies for the villagers, awareness at the time of emergency, Climatic data, Current affairs, performing arts etc. Few local newspapers Communication system- Audio visual communication facility Notice board.
2	E- library and Internet cafe	<ul style="list-style-type: none"> 3-4 computers based on the density of the population. Access to common government documents. Printer facility E-library facility for students
3	Tele-health care and Tele-fisheries space	<ul style="list-style-type: none"> Information about innovate fishing practices. Awareness about resource management Interactive advisory services Entrepreneurial awareness centre. Rural health and sanitation centre Conversion of generic to local specific information related to agriculture, market prices, prices of agricultural inputs and outputs

Support centres (Figure- 9. 32) can be placed along with the existing temples or other religious spaces or even in some public buildings, so that maximum number of people will be given awareness regarding environmental health, public health, also can give awareness regarding the history and culture of the place. For this interactive display screens are placed so that students and other people can come in a common place to get awareness and information (Figure- 9.29).

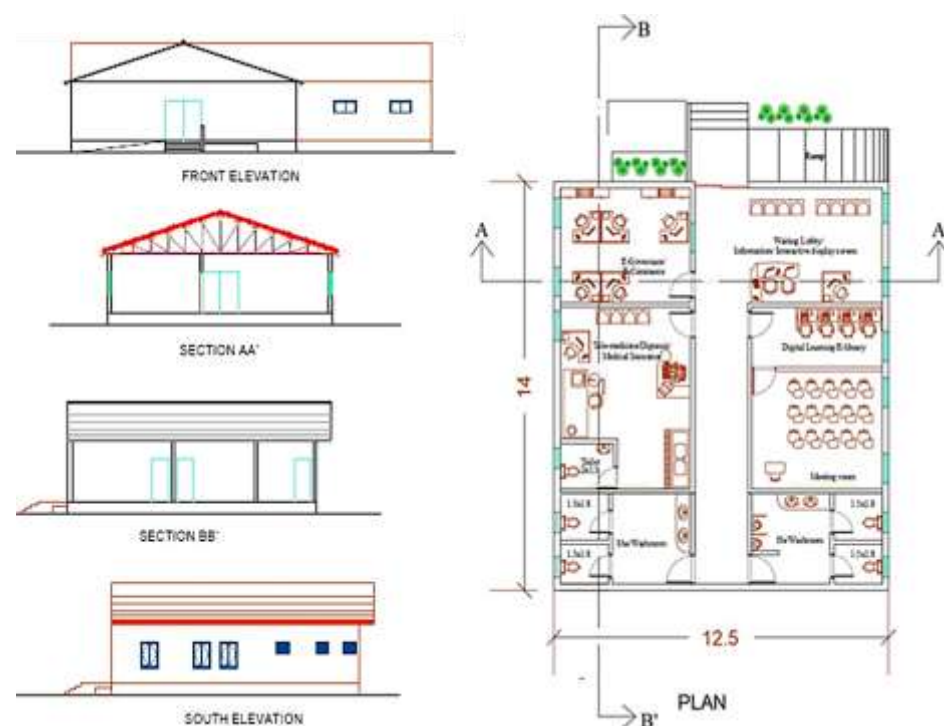


Figure 9-27 Proposed Prototype of Support center in Uppunda village

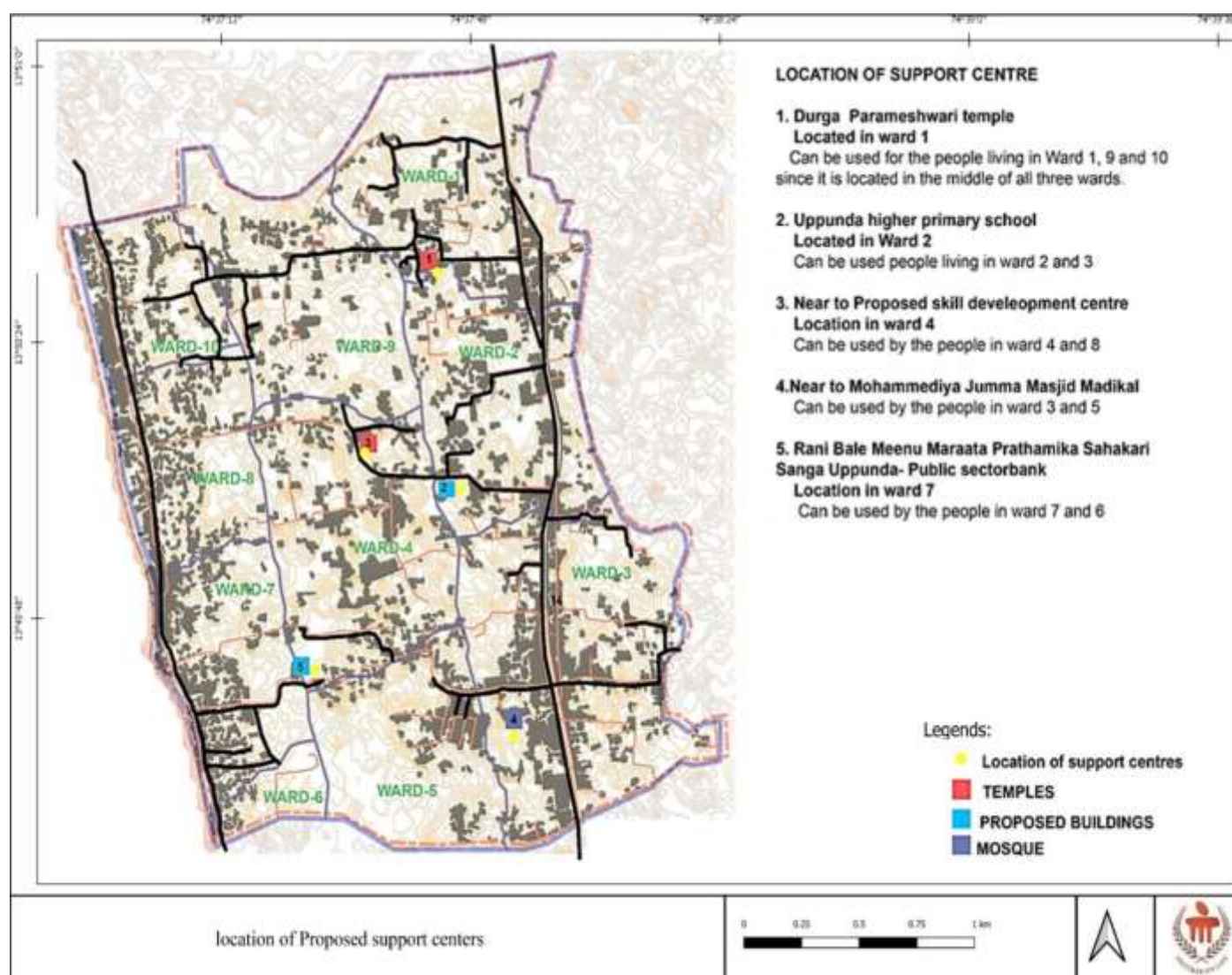


Figure 9-28 location of support centre

9.14. Proposal for Heritage walk and Beach Tourism for Uppunda Village.

Uppunda is strategically situated next to National Highway 66 on one, while it's west coast is on the Arabian Sea. It is also home to one of the largest temple Durgaparameshwari Temple with an influx of thousands of people every year. There are 26 other temples within the village such as Raghavendra Swami Mata, Venkataramana Temple, Mood Ganapathi Temple, Shiva Temple. The people in the village have strong sense for the culture and its protection. The three scenic beaches named Madikal, Uppunda and Batha; Durgaparameshwari Temple situated 500 meters from the

highway and existing transportation infrastructure demonstrate great potential for tourist activity and need to preserve the cultural heritage of the village. This gives great potential for Heritage and Beach Tourism. It is proposed to strategically create a heritage walk connecting important landmarks such as Durgaparameshwari Temple, public buildings, places of cultural relevance like tree katte and the three beaches, for a compelling experience while restoring the cultural identity of the village.

Issues Addressed:

- Historic Conservation
- Creating job opportunities through Tourism
- Giving Identity to the GP
- Cultural heritage management
- Community participation

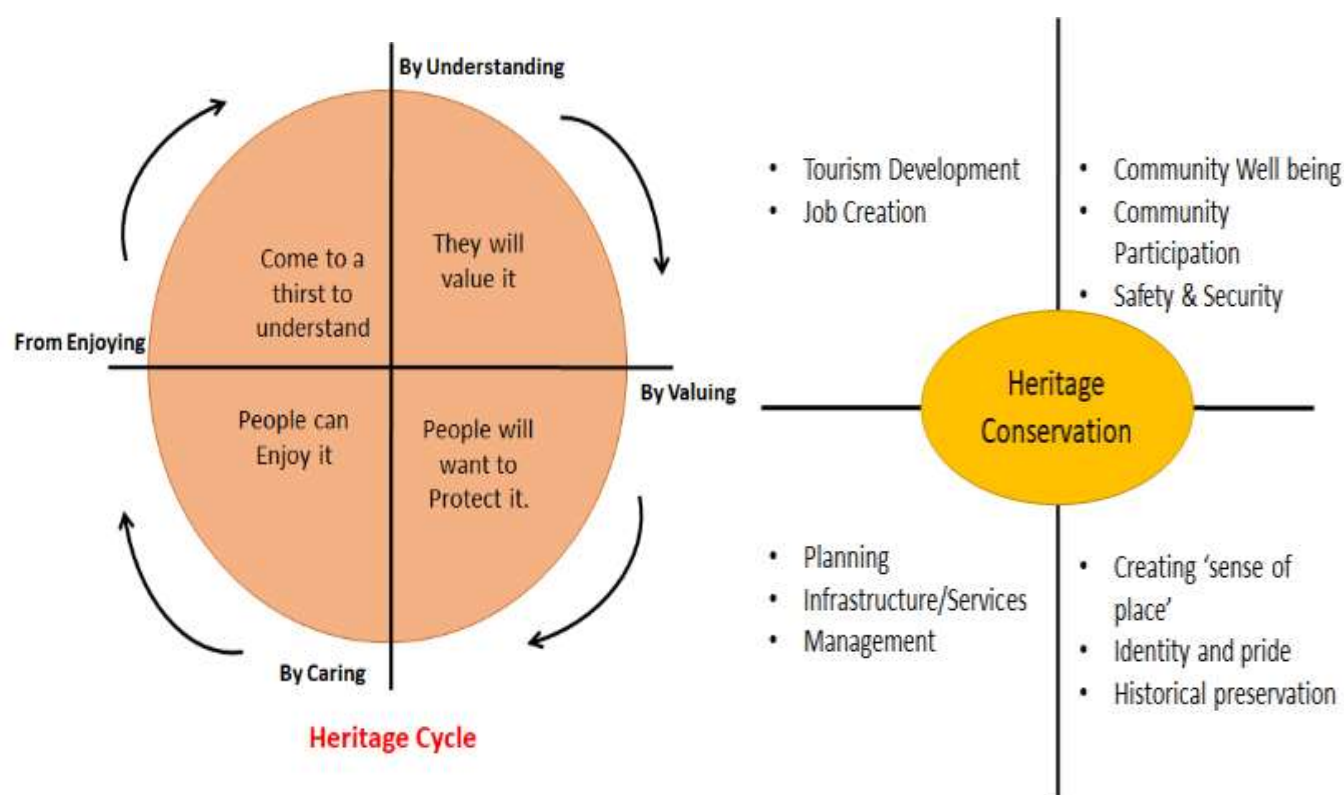


Figure 9-29 concept of Culture of Heritage Management

Justification for the Site Selection:

The site selected for the heritage trail is along the existing roads connecting Durgaparameshwari Temple, the coast and the bustop near the Gram Panchayat office. The reason for choosing the loop is close proximity to bus stops, prominent religious places and the three beaches - Madikal, Batha and Uppunda. The trail is around 5 km long with multiple options to enter and exit the trail.

Framework/Strategies of intervention:

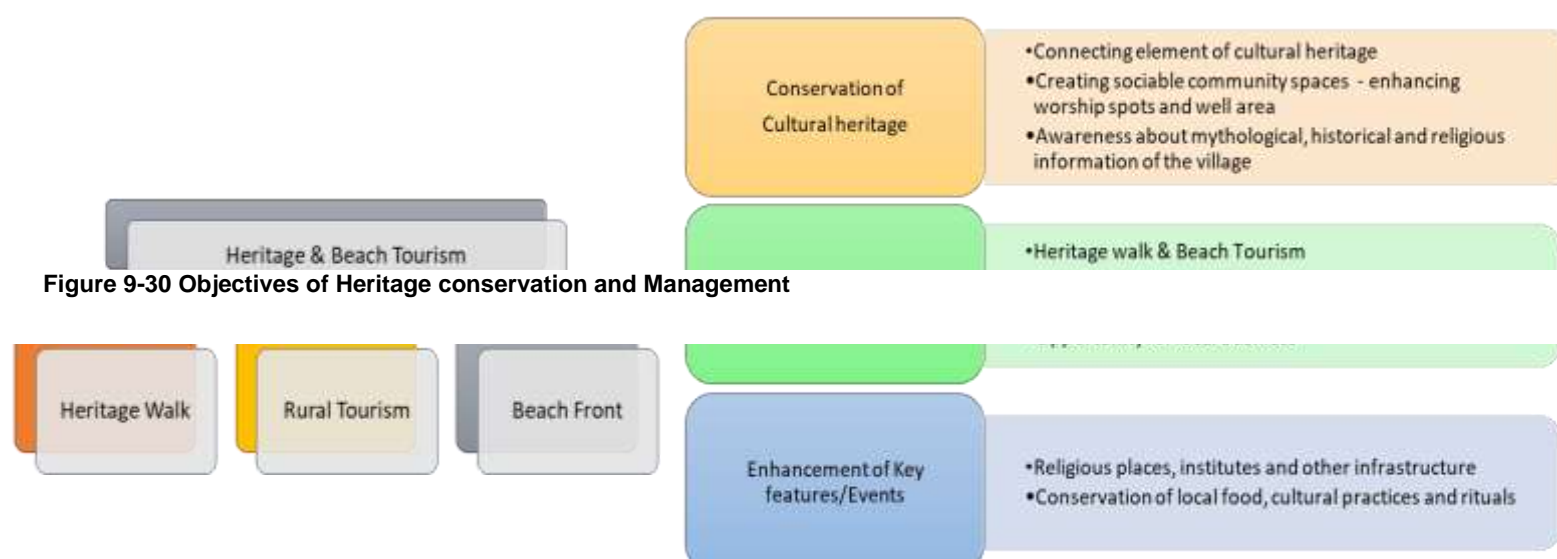


Figure 9-30 Objectives of Heritage conservation and Management

It is important to have a holistic approach while developing tourism opportunities in the interest of local community along with consideration for natural and cultural heritage.

Some of the key strategies are create awareness among people, create platform to sell local products and to promote local food, art and culture while creating opportunities for income generation for the local community.

1. Heritage Walk



The intervention aims at connecting important landmarks of religious importance to the three beaches while creating sociable spaces for local community as well as visitors. The trail would way finding elements for easy navigation and pause points as sociable places including public amenities such as information kiosk, drinking water and shelter. The pause points would also be an opportunity to spread awareness about local culture and history.

- i. Information Kiosks strategically located to provide information about the place, navigation maps and upcoming events
- ii. Community tanks
- iii. Conserving katte – Informal community space (Tree culture)
- iv. Preservation of the stone worship sots - Nagadeva images carved on a flat stone and implanted on a raised platform for worship
- v. Awareness about worship of sea - Ganga Maatha

2. **Rural Tourism:** Any form of tourism that portray the rural life, art, culture, and heritage at rural locations so that it will be benefiting the local community economically and socially as well as provide the relation between the tourists and the local people for a more augment tourism experience can be termed as rural tourism. (Raut, 2019) It is tourism that showcases the rural life, art, culture, craft, cuisine and heritage of rural locations.

- i. Sustainable Rural/spiritual circuit
- ii. Tourism growth can be harness as a method for rural development.
- iii. Economic & Social Development of Local Community.
- iv. Rural Tourism helps to develop the infrastructure
- v. Heritage and Nature Trail: This trail will combine historical, natural, and socio-cultural spaces, including Forest area, Hills, Waterbodies, monuments, temples, built – heritage, etc. This trail also creates a job related to the tourism sector, and it will also look into cultural heritage management.
- vi. Self-employment opportunities
- vii. information centre and a sales outlet providing the necessary backward and forward linkages.
- viii. Agri - tours and firsthand experiences with agricultural practices

3. Beach Front Activity

Madikal, Batha abd Uppunda beach provide a great opportunity to celebrate the natural heritage of the village while promoting cultural aspects and economy. Owing to CRZ guidelines, no permanent construction can take place on the beach front.

- Shacks to promote local cuisine.
- Community locals and small entrepreneurs can set up temporary stalls during festival time to promote locally produced and manufactured products
- The guest's tourist offers to stay with a family to enjoy the delicious local food and experience what everyday life is like.
- Opportunity for sand art exhibition depicting stories of the culture of Uppunda.

9.14.1. Heritage Walk Development:

Figure 9.31 shows map including main public buildings, religious places and beaches in Uppunda Gram Panchayat, depicts the possible areas of intervention with respect to history and culture, based on the existing social and physical infrastructure along with natural setting in background. The zones of intervention are identified due to following reasons:

- The major three areas in the coastal sides are the beach which is first consideration for Uppunda village. These beaches should be considered as the important natural elements in heritage trial. The three areas are the Uppunda beach, Batha beach and Madikal beach area.

- The another important zone is the central zone which have few tree katte which should be considered into religious along with the place of social interaction which in turn should be considered under heritage trail to show case the importance of tree worship done by the villagers.
- The two zones which is Durga Parameshwari temple zone and Uma Maheshwari temple zone are the oldest temples in the village and also has close proximity towards the highway. This zone should be developed for support centers for the villagers to give awareness regarding the history and culture of religious structures in the village.

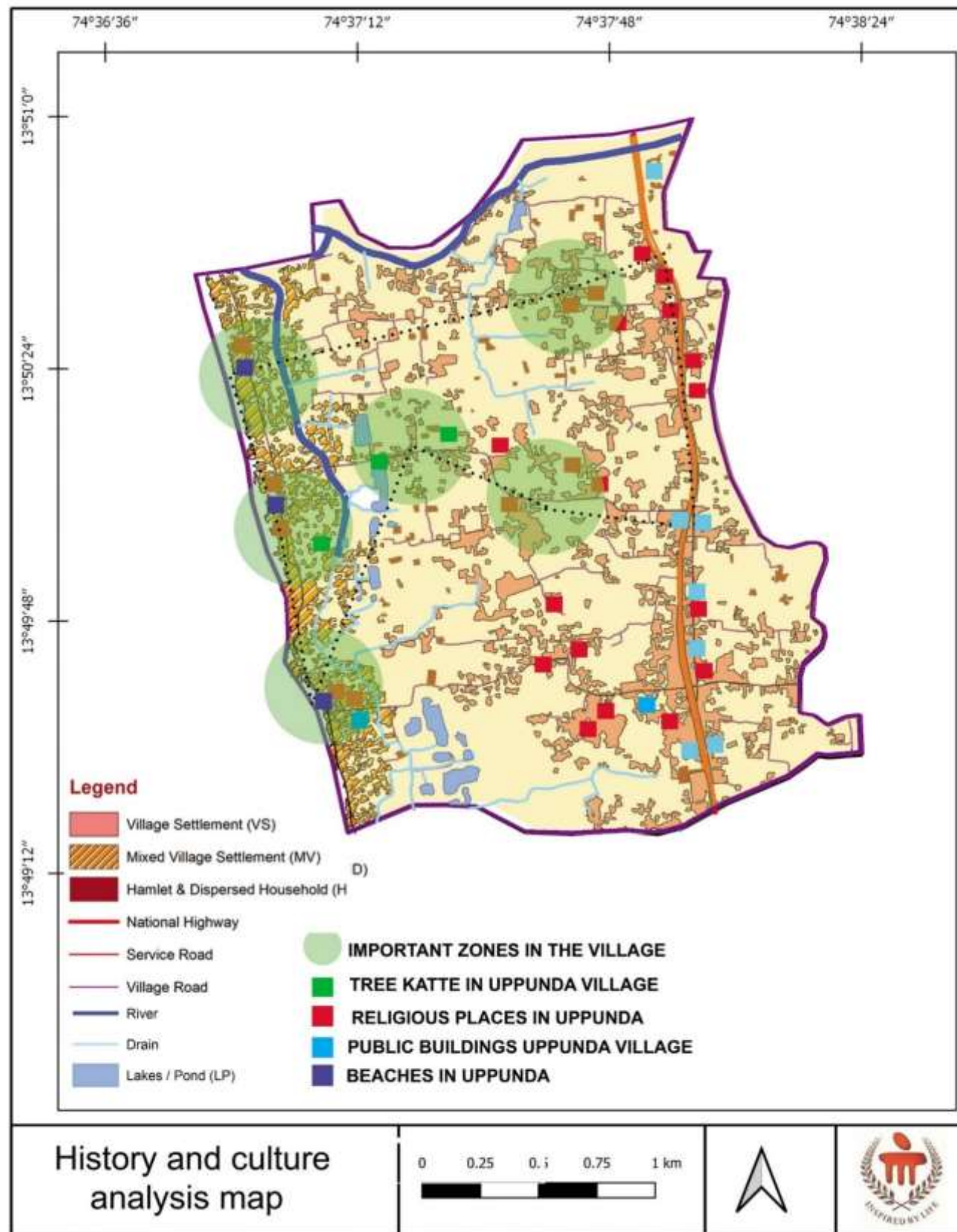


Figure 9-31 Map showing development of Heritage walk loop

- The development of this zones can further increase the community level interaction within the villagers because these zones are the major hotspots and point of interaction at the time of festivals and on also for normal days.
- The enhancement of existing natural resources and heritage structures in the villages considering the selected zones can bring strong identity and uniqueness to the village.



The strong sense of culture should be promoted and encouraged by enhancing the places of religious importance such as tree katte, stone worship shrines, etc. and promoting them as sociable places, while focusing on conservation of cultural heritage. Strengthening physical and social infrastructure will create a safer and more liveable community in the village. Moreover, new developments can take place based on the location of existing infrastructure and amenities such as institutes, health clinics, commercial area and public transport facilities.

Table 9-3 Table showing the intervention zone possible

Temples	Religious spaces	Beach	Other social infrastructure
<ul style="list-style-type: none"> •Durgaparmeshwari Temple •Shri Rama Mandira Temple •Sri Aramkodi Eshwara temple, ETC. 	<ul style="list-style-type: none"> •Katte •Naga shrine •Wells (Semi-Public or Public) 	<ul style="list-style-type: none"> •Medika •Batha •Uppundal 	<ul style="list-style-type: none"> •GP office •Proposed support centre •existing commercial spaces

Enhancing tourism activity in the village will help in highlighting the importance of natural and cultural heritage as well as other cultural practices of the village. This can also provide alternate employment opportunities for the community in off-season and would further help in generating income for local government. Any further development in the village should provide assurance to the people which will not deteriorate the cultural and heritage aspects of the place. Even though they engage and coordinate in the social gatherings neighbourhood level interactions are very less. This should be enhanced to tackle various anti-social activities happening in the villages. Proper community awareness should be given for the growing children in the village to make them understand the importance of inherited occupation and culture identity of the place.

Tourist cycle in Uppunda: Uppundotsava organized at Madikal Beach at Uppunda in the taluk from February 16 to 18. Activities: After the sand art and cattle exhibitions held in the morning, kites of the internationally acclaimed Team Mangalore take the skies in the afternoon. A programme, aptly titled, 'Mane Mattu Mathe' aimed at conserving and holding high the age-old customs and traditions added to the attraction of the festival. An exhibition and sale of kites had also been held at the venue. The car festival is a grand nine day program of evening festivals and it is called 'Kodi habba'. In November 25 the festival usually commences.

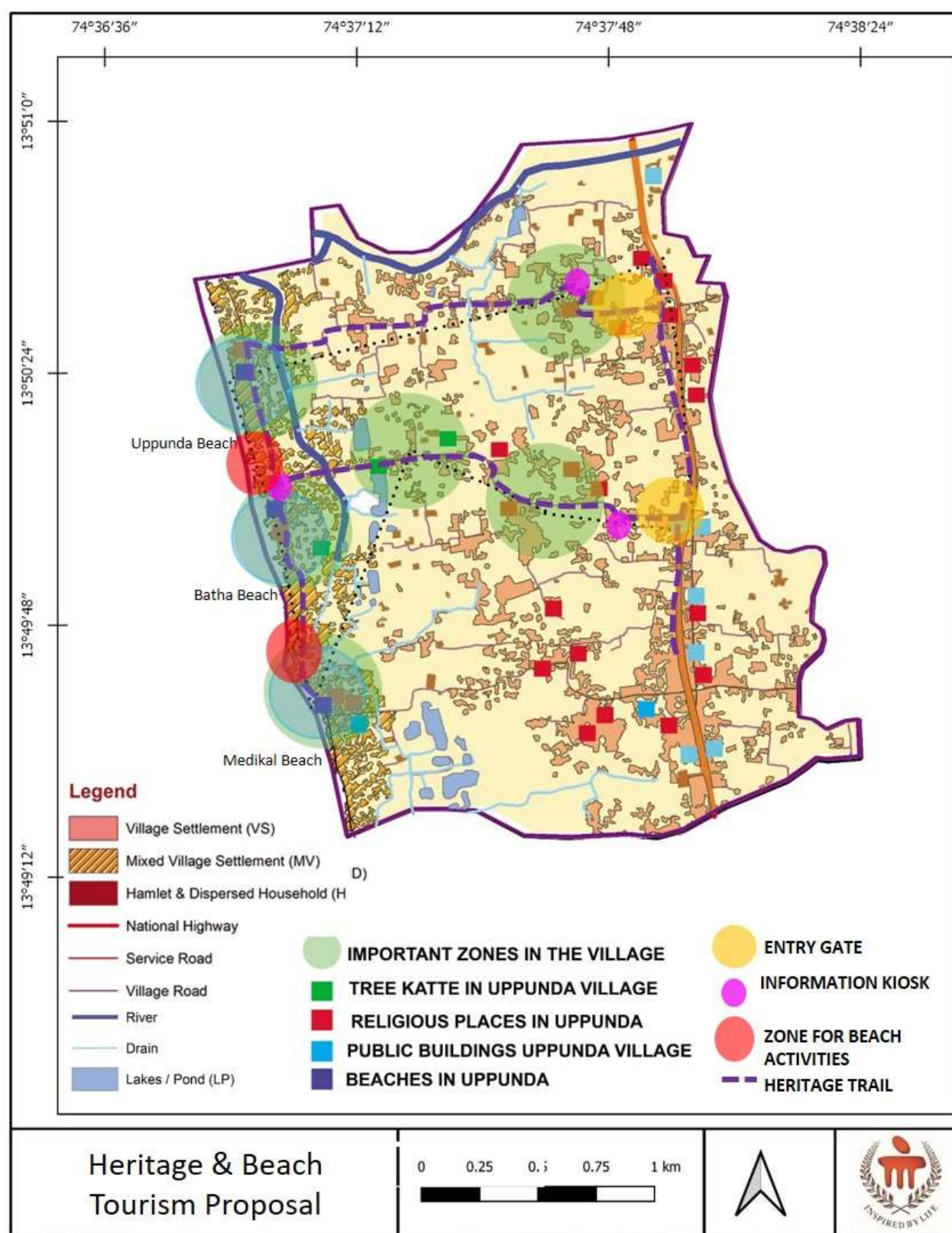


Figure 9-32 Landmark map including the tourist trail with ped shed analysis for the pause points.

For the

Tourist circuit the loop starts from Shri Venkatramana Temple covering Shri Durgaparameshwari temple goes till the madikal beach (Figure- 8.33).

Proposal details:

1. Entrance Gate:

Entrance Gate for the village at the start of the trail for the recognition of the village by using the local materials available.

2. Waiting Area for the visitors with a small kiosk setup by the locals:

From the ped shed analysis pause points were identified along the trail where visitors can rest and shop from the local shop setup by the residents of the village.

Also the resting area was setup with the skill development centre where a market could be setup for the visitors. Along the trail women of the household can set up temporary item sales.

3. Beach tourism:

The locals residing can setup temporary shacks for income generation during festival and non-festival time for the tourists.



Figure 9-33 a) Entrance Gate, (b) Waiting Areas, (c) Proposed Temporary Shacks (Source: Google Images)



9.15. Proposal for Skill development and Vocational Training Centre at Uppunda Village.

Skill development and Vocational Training Centre has been identified on the problems faced by the villagers. The need and demand of the panchayat has been considered for the training facilities of the Centre. The training facilities has been divided into three sectors mainly Construction, Technical & Non-technical (Figure- 8.39). Training under this sector has been identified in which Construction sector will have for Plumbing, Mason, Welding, Carpentry and shuttering. Technical sector will have Agriculture programs, Electrical, RAC, Automobile and Appliances: Home appliances, DTH Lab, Mobile hardware lab, CCTV Installation. Non-Technical sector will have Retail, Tailoring, Front office, Beauty & wellness and Housekeeping. For this three sectors Class room and Lab complex (Figure- 8.40) is provided which will

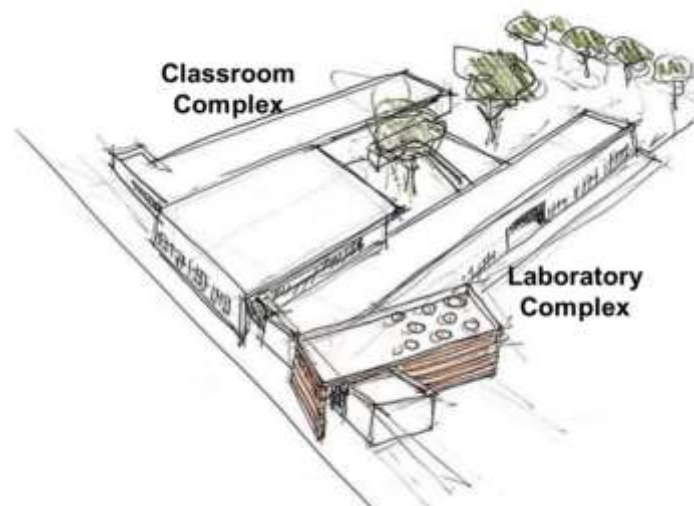


Figure 9-34 : Conceptual sketch for Building Complex for Skill development and Vocational Training Center)

have different training facilities. Class room complex will have class rooms, computer labs, smart class rooms, counselling rooms, seminar rooms & toilet facilities. Lab complex with have workshop area for mason, shuttering, bar bending, electrical, RAC, plumbing, retail, tailoring, beauty & wellness and front office with toilet facilities. All the training facilities provided in the Centre will have flexibility in timing for Youths and Adults of the panchayat.

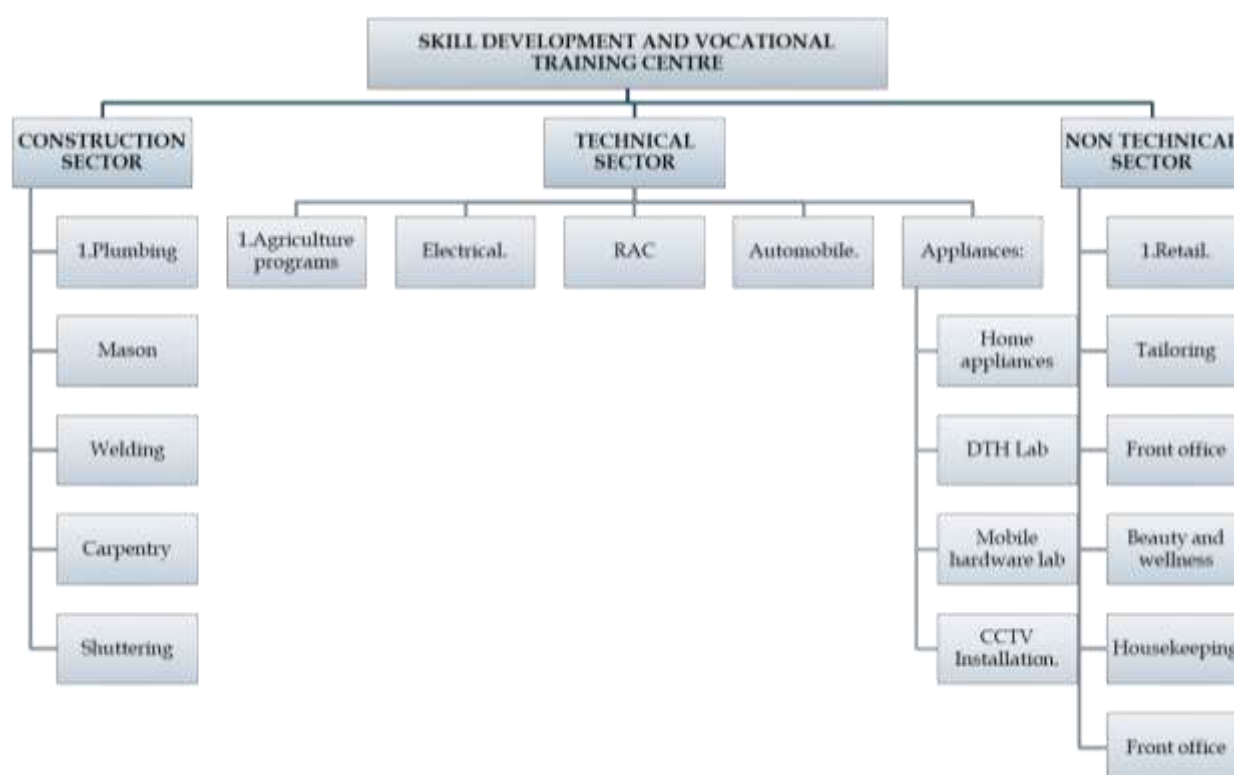


Figure 9-35 : Skill development and Vocational Training Centre – Building complex

9.15.1. Area Statement of Proposed Built form:

A. Class room complex - Construction sector, Technical sector & Non-technical sector.

CLASS ROOM COMPLEX - CONSTRUCTION SECTOR, TECHNICAL SECTOR & NON-TECHNICAL SECTOR					
SR. NO.	ROOM NAME	AREA SQ.MT	TOTAL AREA SQ.MT	NUMBER OF PEOPLE (PER CLASS ROOM)	TOTAL NUMBER OF PEOPLE
1.	class room (4 nos)	35	140	30	120
2.	computer lab (2 nos)	100	200	40	80
3	smart class (2 nos)	45	90	30	60
4	counselling room (2 nos)	45	90	10	20
5	seminar room (2 nos)	65	130	50	100
6	toilet (male & female) (2 nos)	38	76	12	24
ground floor area			800		520
total area (g + 1)			1600		1040

B. Lab complex - Construction sector, Technical sector & Non-technical sector.

LAB COMPLEX - CONSTRUCTION SECTOR, TECHNICAL SECTOR & NON-TECHNICAL SECTOR			
SR. NO.	ROOM NAME	AREA SQ.MT	TOTAL NUMBER OF PEOPLE
ground floor			
1.	workshop area 1 –mason, shuttering & bar bending lab	255	50
2	workshop area 2 –electrical & rac lab	212	80
3	workshop area 3 –plumbing lab	110	10
4	toilet (male & female) (2 nos)	38	12
ground floor area		615	140
first floor			
1.	workshop area 4 –reatil & tailoring lab	255	50
2	workshop area 5 –beauty and wellness lab & front office lab	212	80
3	workshop area 6 –appliances lab	110	10
4	toilet (male & female) (2 nos)	38	12
first floor area		615	140
total area (g + 1)		1230	280

C. Skill development and Vocational Training centre.

Skill development and Vocational Training centre.			
SR. NO.	BUIDING COMPLEX	AREA SQ.MT	TOTAL NUMBER OF PEOPLE
1.	class room complex - construction sector, technical sector & non-technical sector	800	1040
	lab complex - construction sector, technical sector & non-technical sector	615	280
total area (floor area)		1215	1320

D. Schedule for Class room & Lab complex.

TRAINING TIMING - CLASS ROOM & LAB COMPLEX.



TARGET USER	TIMING	COURSE OFFERED	DURATION
youth (15 – 25) male & female	8 – 12 am (morning session)	construction sector, technical sector & non-technical sector	3 – 6 months
adults (25+) male & female	2 – 6 pm (afternoon session)	construction sector, technical sector & non-technical sector	– 6 months

9.15.2.Guidelines for Setting up of Skill Development Centre under Pradhan Mantri Kaushal Kendra.

A. Formulation for a Core team and training:

A core team should be formulated and give orientation towards the Skill development and vocation training Centre. The core team should consist of a Project Coordinator, one Account cum admin assistant and 2 community organizers to achieve all the goals which was identified in formulation of this Centre. The staff will be planned according to the course who will have to provide necessary materials for their understanding and make a syllabus for the vocational and skill development training.

B. Signing of Course Curriculum and facilities:

The training programs comprising of two segments i.e. classroom and Laboratory work. The course wise curriculum will be designed in association with experts

from the industries based on market demand and aims at integrating experiential practical learning in the field and theoretical understanding in the classroom. Along with continuous personality development for the trainees is undertaken with the support of identified schemes Pradhan Mantri Kaushal Vikas Yojana (PMKVY) is considered. Learning methods will include observation, discussion, action, presentation and examination. Pre assessment, midterm assessment and final assessment to be conducted at project level as a part of monitoring and evaluation. After the final evaluation, the certificate to be awarded.

C. Eligibility and Selection of trainees:

Any poor person is eligible for this training based on trade. People who are unemployed and BPL members will be prepared. Application forms should be available in the project office, with Community Organizers. The Project Coordinator should be available for any query related training. The general criteria of selection trainees will be:

- They should be from the same village.
- They should have basic interest and zeal for their development.
- They should be free from other work obligations for minimum of four hours.
- They should be literate with minimum of 7th standard in order to make effective communication.



Figure 9-36 Site plan for Skill development and Vocational Training centre

9.15.3. Policy Guidelines for Setting up a skill development center under Pradhan Mantri Kaushal Kendra.

S.no	Attribute	Parameter	Conditionality	Remarks
1	Size of Centre	Category A – Minimum. 8000 Sq.ft Category B – Minimum. 5000 Sq.ft Category C – Minimum. 3000 Sq.ft	Mandatory	
2	Ownership	Yes/No	Desired	
3	Lease/Rental/Maintenance Agreement Terms	Registered Rent Agreement for 3 years OR Lease agreement for a period of 11 months along with an undertaking to renew the lease at the end of every 11 months, during the period of three years.	Mandatory	Applicable to all leased or rented centres
4	Open Area (Area other than built area within boundary wall	Category A – Minimum. 800 Sq.ft Category B – Minimum. 500 Sq.ft Category C – Minimum. 300 Sq.ft	Desired	
5	Parking	10 two-wheelers, Cycle stand	Desired	
6	Approach	Located near (at walking distance) from a major approach road (highway/main market road) Conveniently close to public transport facility (Bus stand/Railway station/Metro station) Having adequate road lights and public movement	Desired	
7	Approach Road	The approach road should preferably be a pucca main road with a minimum width of 12 ft, If the centre is on an arterial road then the distance should not be more than 500 meters from main road and that arterial road should be at least 8 ft wide		
8	Distance to nearest Public Transport	Distance to nearest public transport: Access to nearest public transport facility, which could be a bus stand, auto stand or railway station should not be more than 5 km away from the centre location	Mandatory	
9	Number of Classrooms	Category A – Minimum 5 Category B – Minimum 3 Category C – Minimum 2	Mandatory	
10	Class Room Area	10 Sq.ft per trainee	Mandatory	Classroom size for a particular job area to be as per defined SSC specifications



9.16. Proposal for Economic Development Centre at Uppunda Village.

The proposal is developed on the broad objectives for rural development strategies in lines with MSME guidelines. The proposal strives for economic development to build economically sustained within the rural landscape. The proposal comprises Economic Development Centre has 3 aspects – a) Centre space which will be accessible for all the rural people b) Creating employment opportunity by encouraging small scale industries c) Trade for agriculture and fishing industries for import and export. The planning phases includes mapping of small enterprises and identifying its potential, facilities for new start up and opportunities for employment. (Table 9-4).

Table 9-4 Economic Development Planning

Mapping	Micro and small enterprises within the Panchayat area.
	Enterprises opportunity for the village
	Opportunities for different categories
Identification	Potential candidate to set up enterprises.
	Skill and interest of the candidates
Facility	Job opportunity
	Facilitate policy for new start up
	Support for new enterprises
	Support for woman by encouraging home based product
Maintain	Database for labors and employment
	Database for labors and employment
Create	Economical protection
	Equitable wages for men and women, zero child labor

Small Scale Industries:

Using the word small-scale industry does not mean small industry size. It just means a limited commercial unit scale. Small-scale business estimates vary depending on the small-scale sector concept. "Modern Small-Scale" industries are those that use power and machinery. To conclude, three metrics are commonly used to calculate operation scale or firm size. Production, employment, capital estimation. Physical production, say tones, may be used to calculate firm scale. Output value can be used by multiplying the physical measure by price per output unit. The product's price can vary annually. The following enlisted industries are proposed for the Uppunda Gram panchayat to create employment opportunities for the rural people.



Figure 9-37 Strategic Development for Uppunda Economic Development Centre.

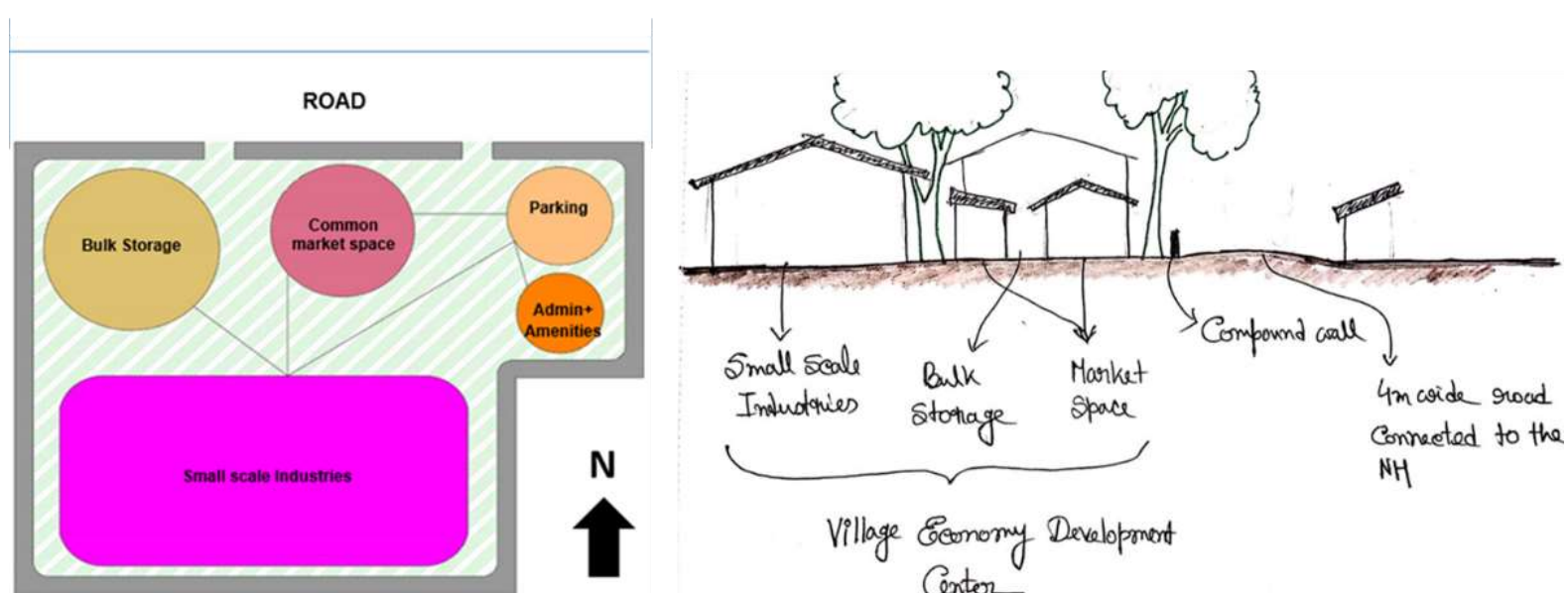


Figure 9-38 conceptual design of economic development centre

Strategic Development: The two main strategies that need to be followed for this designing the centre is economic and social life (Figure 8.43). Boosting of economy also enhances the quality of life. More job opportunity can enhance the woman empowerment and standard healthy life. It shall enable young and promising entrepreneurs to develop and carry out rural entrepreneurship activities. It shall also increase villagers' literacy rates. Their schooling and self-employment would improve the community's quality of living. Rural The proposal shall also help to optimise the use of local resources such as raw materials and labour for useful purposes, thus increasing productivity. Entrepreneurs use scarce capital wisely which successfully leads to an area's greater economic growth. It would result in producing more

output, jobs and prosperity by leveraging new ways to increase rural people's per capita income. Improvements in local productivity through the proposal shall contribute to promote prosperity.

This proposed Economic Development Center has four basic wings for serving its purposes (Figure- 8.44). The first wing has common marketing space, second wing has the storage area, third wing has the small scales industries, and fourth wing has the entire administrative department.

These four wings are connected with each other. The Common market space and administrative department can act as a public area. Bulk storage can act as a semipublic area. The people are restricted till the public area only. Small scale industry can act as private area which can be accessible by the employee and workers. But all the wings are interconnected with each other for better facility.

Parking area is only for the employee and transportation people associated with this center.



Figure 9-39 Canteen area with informal sitting

WING-1: Common marketing area:

Common trade area is where the entire manufactured product can be sale together. The function is oriented to production rather than consumption. This common market space is a fixed place where purchasing will be easy by the consumer as variety of product will be under the single umbrella (Figure 8.44). This will act for the display of local produce to the outside buyers also.

The home base any product like different masalas, Agarbati which village woman can make themselves in their home also encourage to sell their product in this trading area. Daily needed products like vegetables, grocery also can be sale here. Total requirement of area is 2000smt. This space can attract tourist also for their window shopping from the village. This space is commonly used by the public for creating an informal space to encourage more economic flow. The wholesale market or any retailer shop both can be encouraged to sale their product.

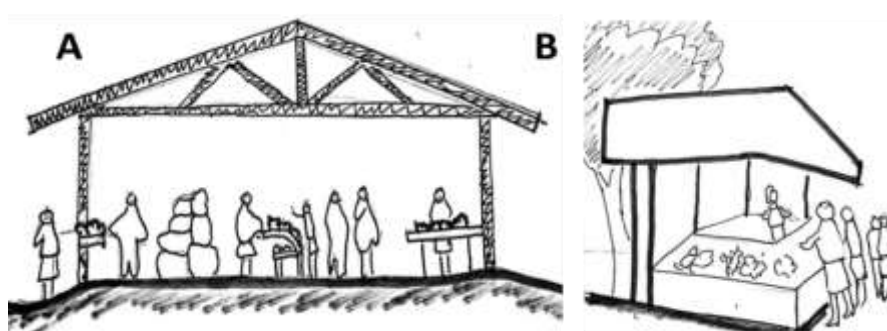


Figure 9-40 retail and wholesale market sketch

WING-2: Bulk storage:

Fertilizers and seeds and crop storage for bulk amount product can be encouraged to store here. Cold storage also can be set-up for perishable item. Total requirement of area is 2500smt. It is building where bulk amount of good can be stored both perishable and nonperishable items. This bulk storage also can encourage job opportunity. It can be accessible by the manufacturer and wholesaler. It comprises with loading and unloading facility. The storage is important for any kind of industries to promote more economical transaction.

WING-3: Administrative and amenities:

The important part is administrative department for look after all the process. This administrative department also comprises with e-commerce area. Other amenities like parking facility, public toilet, drinking water, canteen area, loading and unloading area can be included (Fiigure 8.45). Total area required 1500smt.

WING-4: Small scale industries:

The small scale industries refer to the small manufacturing activity which can be done in Gram Panchayat. They are small in their scale of production that is in the scale of output that they produce per day or per week. They can cater to local markets and order also can be taken from big factories. The size of the industrial unit is small so it is easy to start any entrepreneurship. Product dependent on cheap raw material and profit can be generated easily.



A. Dry Fish Industry:

Uppunda is a coastal village and has wide scope of large fishing business. Fishing is the one of the prominent occupation seen in every ward. But during period of June to August (fish breeding season) fishermen are jobless as they cannot able to catch fish. Dry fish production is a profitable business and has market demand. Drying is a food preservation system that works by the extraction of water from food, which prevents production of microorganisms and hinders decline in nutrition (Figure 9.41). Sun and wind have been used to reduce decay in ancient



Figure 9-41 Traditional methods vs Modern equipped methods for Fish Drying

times and have been a traditional fish curing. Solar energy is used for fish water drying.

Dry fish production and trade offer a sustainable employment and income to the coastal fisherwomen. To set up this industry total area required 420 sq.mt which included storage for perishable & nonperishable item, washing and cleaning area, processing area for hot air circulation and packaging area. Along with the traditional methods of fish drying, modern machinery methods could also be practiced. The cost of the drying oven machine varies from Rs. 22,500 up to 5 lakhs based on the capacity and automation grade.

B. Shrimp Papad Industry:

Shrimp has a major export value worldwide and it is an important item in sea food production. India is a shrimp-developing leading country. Shrimp remained the highest product export-value. Adding shrimp value would further enhance shrimp demand and export. India's shrimp community and production ranks second. Shrimp is extremely perishable in nature, while dry shrimp can be stored for a long time without any consistency loss. Papad is one of the traditional food in India and also

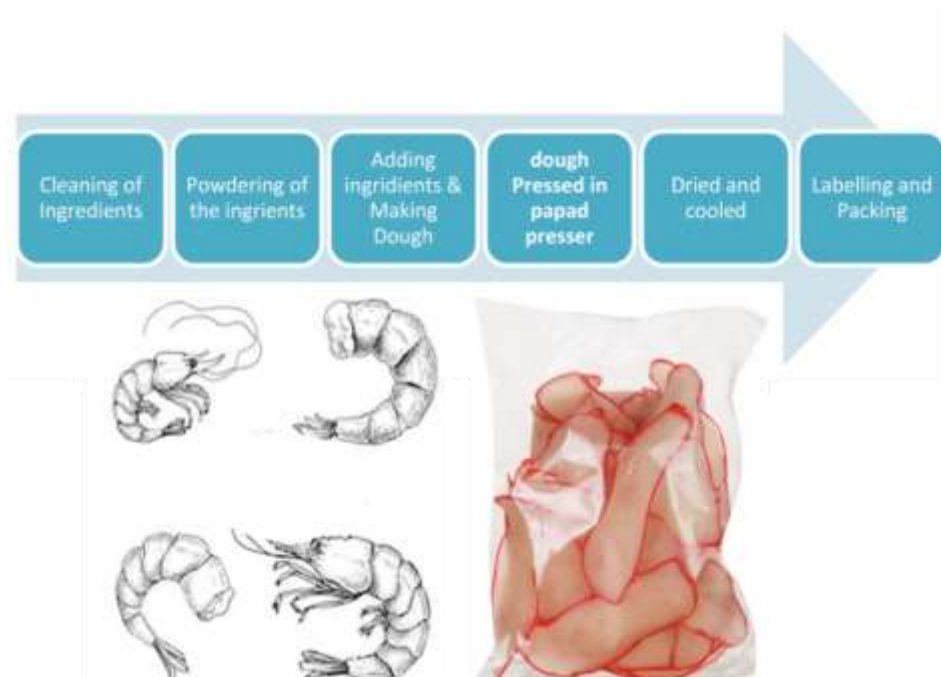


Figure 9-42 : Process of Shrimp Papad manufacturing

has a demand in foreign countries. Shrimp papad is an instant food and can be fried in oil or oven deep in it. As shrimp is local product so making of shrimp Papad can create a good market and also generates employment opportunities for rural people. Keeping this in view, it is envisaged that there is good scope for the development of shrimp papad making industry in Uppunda. Making shrimp papad is fast and quick process (Figure- 8.47). Black gram dal powder, shrimp powder, spices, salt and sodium carbonate (optional). A mixer blends all ingredients to produce a homogeneous dough. Small 10gm dough balls are shaped in a papad presser to form thin papad sheet. Dried and wrapped in polythene bags. Total requirement of area is 300smt which will have drying area for Shrimp, storage area for perishable and non-perishable item, processing and packaging area.

C. Fish Pickle Industry:

Fish products contribute to develop economy with locally available fish. Like vegetable pickle fish pickle also has a demand. Authentic traditional fish pickle can easily attract market demand. Fish / Prawn pickle, when carefully handled in most hygienic conditions with addition of salt, preservatives and spices would usually have an estimated shelf life of one year (Figure 8.48). Most of the sea fish like Prawn, Tuna, Pomfret, Mackerel, etc. are ideally suitable for making fish pickles. They are packed in air tight sterilized bottles. No significant pollution effluent is used for washing purposes. However, a battery of pre-treatment tanks should be mounted and no objection certificate can be received from the concerned State Pollution Control Board. For energy Conservation, only power is used; hence correct HP motors should be used with machine. For this industry 200 sq.mt area is required. It also helps to generate woman employment.



Figure 9-43 Manufacturing Process of Fish Pickle.

D. Production from paddy:

Rice, considered a major staple food and nutrient source in many parts of the world, is also an important staple food in India. Given that rice qualities are different from region to region, demand for parboiled brown rice has increased due to its popularity for nutritional quality and health claims associated with eating this form of rice. Uppunda has paddy production in agriculture field. This paddy also can be used to make puffed rice or Poha (Figure 8.49). Puffed rice is use in all over India for making chats. Poha is also acceptable by all the Indians. This is small industry and can generate alternative job opportunity. Total area required for this is 400 sq.mt including cleaning and drying area for paddy, processing area, storage and packaging area. This type of industry shall provide more opportunities for the Home-makers of Uppunda who can be a part of the scheme after their daily household works.

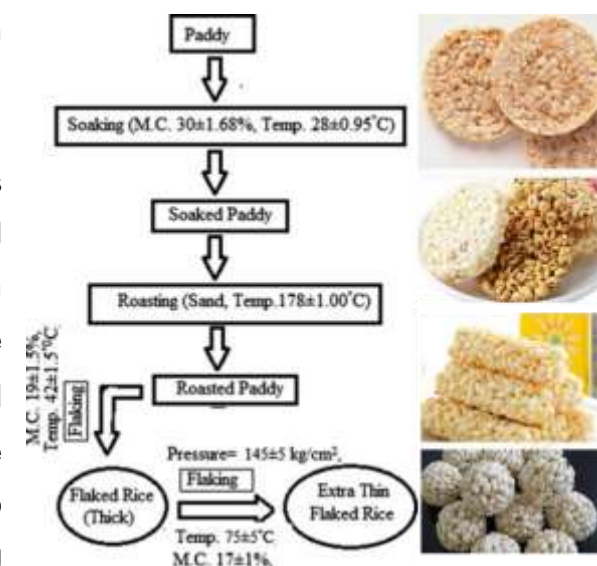


Figure 9-44: Manufacturing Process of Puffed Rice

E. Coconut, Arecanut, Groundnut based product:

Uppunda is a coastal village and coconut trees are abundantly grown in this region. Many products can be manufactured from coconut trees and coconut like rope, green coconut, coconut oil, dry coconut, coconut milk powder, leaf can be used in making of broom stick, ecofriendly straw etc. For coconut based product total area requirement is 1500 sq.mt. For Arecanut based industry required only 500smt.

Coconut de-fibring: Coconut fibre is a plant fibre from husk and is used in floor mats, doormats, Brushes, mattresses (Figure 8.50). Choir is the fibrous substance found between the internal hard shell and coconut outer coat. White coir harvested from unripe coconuts and is used for making finer brushes, cords and fishing net.



Figure 9-45 Coconut Defibring



Pre-Cooling Conditions: Room-cooling is generally used for mature husked nuts. Forced-air and hydro-cooling are acceptable. A rapid temperature changes of 8°C (46.4°F) can cause cracking.

Optimum Storage Conditions: Mature coconuts with their husks can be kept at ambient conditions for 3 to 5 months before the liquid endosperm has evaporated. Storage at 0 to 1.5°C (32 to 35°F) and 75 to 85% RH is possible for up to 60 days for mature de-husked coconuts and 13 to 16°C (55 to 60°F) and 80 to 85% RH for 2 weeks or less. Low RH and high temperature should be avoided (Figure 8.51).

Chilling Sensitivity: When stored at 0°C (32°F), the green skins of immature nuts turn brown after 7 days and changes occur in other quality characteristics. Chilling injury is not seen when coconuts are stored at 5°C (41°F) for 6 weeks.



Figure 9-46 Coconut Storage

Peanut is a mass-consumption item used to extract oil, produce butter, chikki and chocolates, as an ingredient in making many food and snack preparations, munching, etc. Groundnut is a 2-crop plantation, with winter crops contributing more than summer crops. Shell groundnuts (pods) are de-stoned and de-shelled for peanuts. They are sold on the market after rating them to various sizes (known as counts). Peanuts of medium size once brought to the market yards are then roasted in electrically operated roaster. Ground nut industry required 1200 sq.mt.

9.17. Proposal for Road Infrastructure at Uppunda Village

Table 9-5: Stages of Road Infrastructure Development

STAGES	TYPE OF DEVELOPMENT	DURATION	METHODS (PROPOSAL)	INTERVENTION
1st	Repair	2 - 5 Years	<ol style="list-style-type: none"> 1. To repair and maintain existing road system (3m-5m width) 2. To channelise storm water 3. To provide adequate street lighting 4. To improve connectivity and access 5. To add bus stops 6. To segregate traffic movement 7. Community engagement in maintenance 	Cambering:
				Adjust Slope of road in cross section to 3-3.5% to allow smooth surface runoff and avoid flooding
				Road Edge Treatment:
				Rectify road shoulders and add covered storm water channels
2nd	Redevelop	10 - 15 Years	<ol style="list-style-type: none"> 1. Widen roads to accommodate two-way traffic and street furniture 2. To regulate maintenance of road system 3. To provide better storm water drain system 4. Use alternative raw material to construct the roads. 5. Community engagement in maintenance 	Road Cross-section improvement:
				<ol style="list-style-type: none"> 1. Interior and Exterior loop roads: increase carriageway to 7.5-8.0mt. 2. Add footpaths on either side of roads 3. Introduce stone/gravel roads for connecting remote habitations 4. Repair and maintain bridge
3rd	Maintain	15 - 30 Years	<ol style="list-style-type: none"> 1. To repair, maintain and regulate road management system through community engagement 2. Restrict widening of existing roads 3. Restrict addition of any new roads 4. If necessary, add more gravel/stone roads to connect all habitations 5. Improve bridge connecting wards 8 & 10 	Develop a road management and monitoring system:
				ward wise maintenance committees
				Improve connecting bridge:
				Reinforce or Rebuild the existing Bridge/bridges connecting the wards to coastal area

As per study, there is not much space for developing the roads in terms of road widening or level-raising. The approach here is to adapt- repair and maintenance as opposed to building new roads or propose for drastic widening. The idea is that we provide connectivity to main roads, correct the road section and add allied infrastructure to support the roads edges and the needs of the villagers who travel for school, work, within village or even during medical emergencies etc. Based on the development plan has done stage wise (Table 8.2).

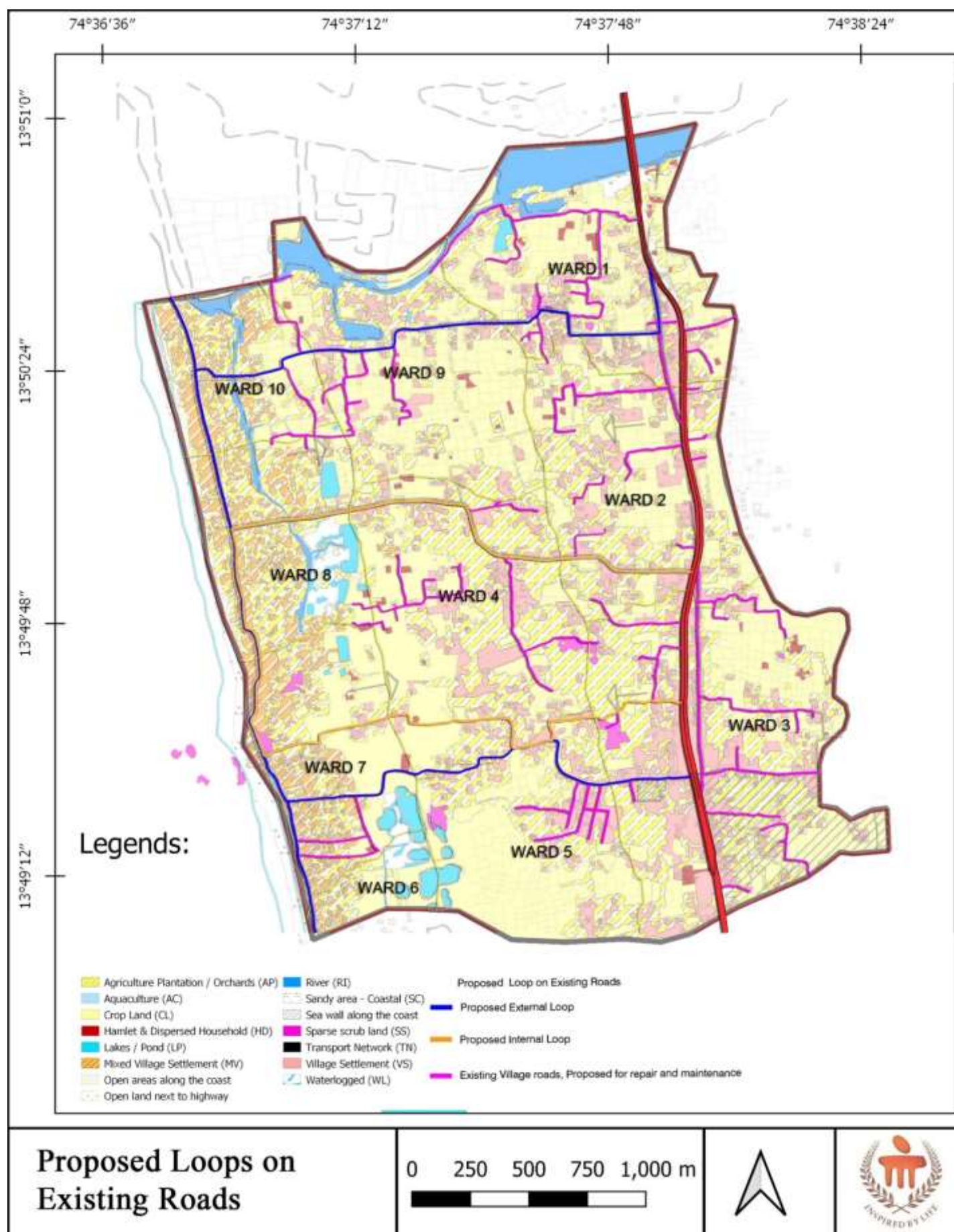


Figure 9-47 Base Map for Proposed Loop System for Road Infrastructure

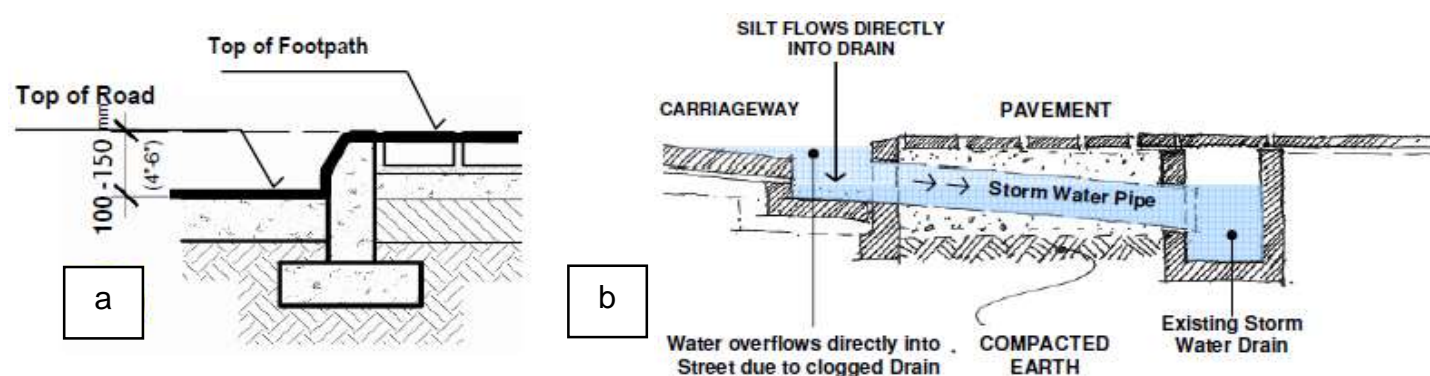


Figure 9-48 : Phase 1 Intervention Details (a) Maximum Kerb height, (b) Storm Water Management

(Source: Romi Roy, Sr. Consultant, UTTIPEC DDA, Oct 2009)



9.17.1. Developing a loop system:

the existing roads can be used to form a ring road or a loop road that goes through the village which can be used as part of the bus circuit or even heavy vehicle movement (depending on which roads are used for the loop). In Uppunda Village we can demonstrate this by having two such loops:

- I. **An external loop/ring road:** this road (marked in blue below) will act as the external loop that will allow the larger vehicles or medium to high volume traffic to come in from the NH66. This road is passing through the wards: 1, 9 and 10 in the north, 8 and 7 along the coast and then finally exits through wards 5, 3. The advantage of this is that the larger vehicle movement can be diverted through this road to access the beach for tourism or even trading purposes without disturbing the privacy or daily activity of the villagers.
- II. **An internal loop road:** the aim of creating this loop (marked in ochre) again is to allow for low or medium volume movement and since it will overlap with part of the coastal loop as well, it creates a connection for the interior part of the village to both the ends- coast and highway. These roads will be important specially during emergencies and will be meant for the villagers to use freely without the threat of heavy vehicles coming in.

9.17.2. Improving the road section:

From onsite observation, analysis and issue identification we see that the road sections need to be corrected or enhanced so as to curb issues related to accessibility, flooding, storm water drainage (Figure 8.47) and adding facilities that are important for activation of the road edges.

In Uppunda village this can be demonstrated in the following ways based on the Table 8.2.

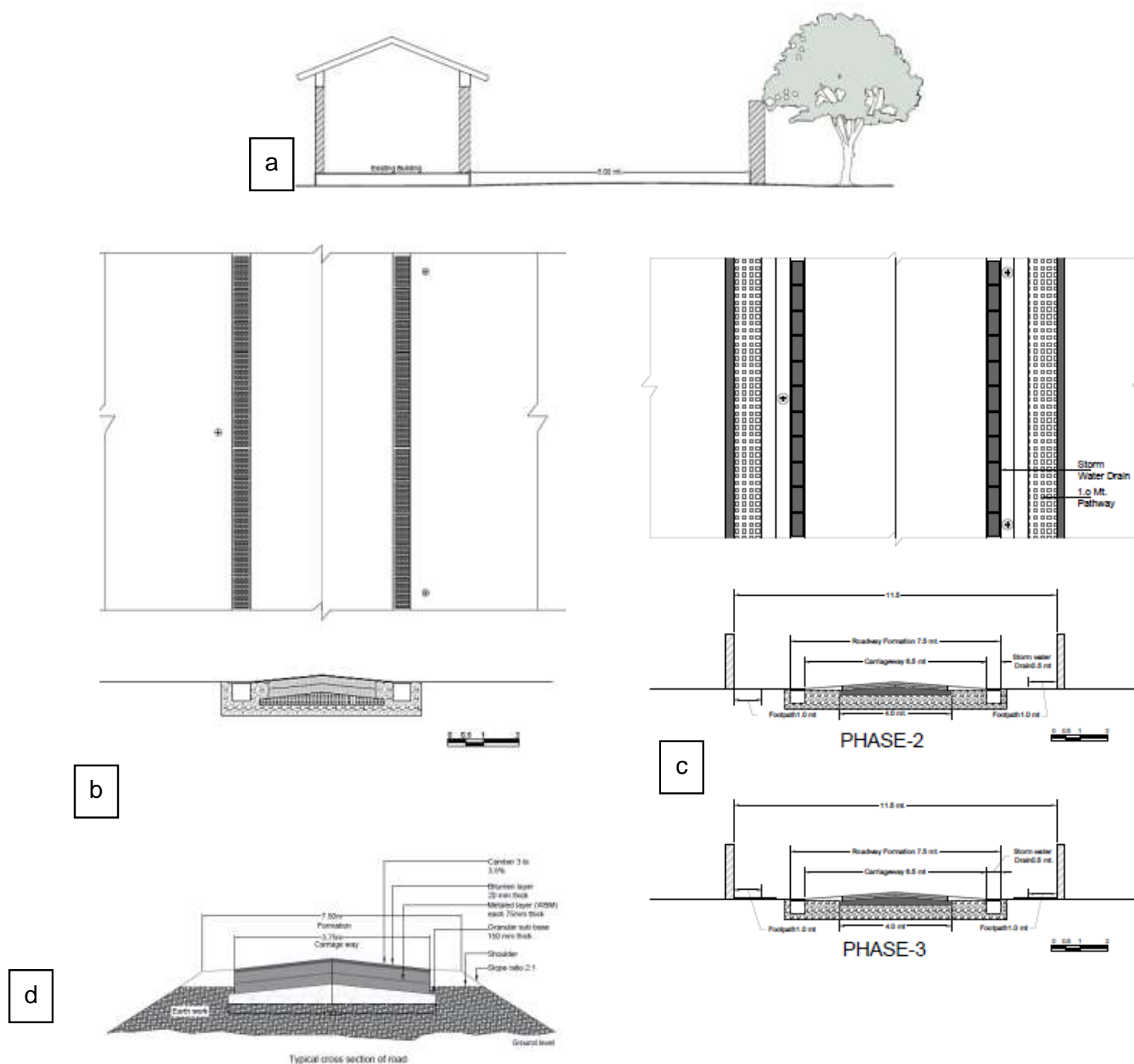


Figure 9-49 a) Existing Mud Road Condition, (b) Proposal for Phase 1, (c) Proposal for Phase 2 & Phase 3, (d) Typical Cross section of Road Design. (Source: Author)

A. Proposal for street light:

- Spacing of streetlight should be based on the intensity of light, height of the fixture and clearances from tree canopies.
- White lighting at 25-40 lux for footpaths is recommended.
- For pedestrian walk, it is recommended to have light pole height from 3mt to 5tm and for major arterial intersections can be restricted to not more than 12mt.

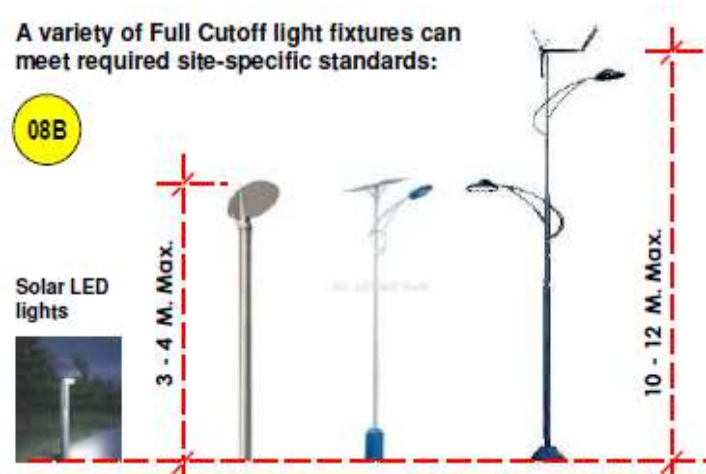


Figure 9-50 Street Light Fixture Detail

9.18. Housing Typologies & Design and Construction

Uppunda village have 10 wards where Ward 1, 2 and 3 is located close to National Highway (NH) 66. Wards 4, 5 and 9 is positioned in the centre of the village which approximately is at a 1km distance from the NH. Ward 6, 7 and 10 are close to the coast line within the 100mts distance from the shoreline. On the basis of proposing our design guidelines, we have delineated 3 demo areas (Figure 8.56) for carrying out the design interventions.

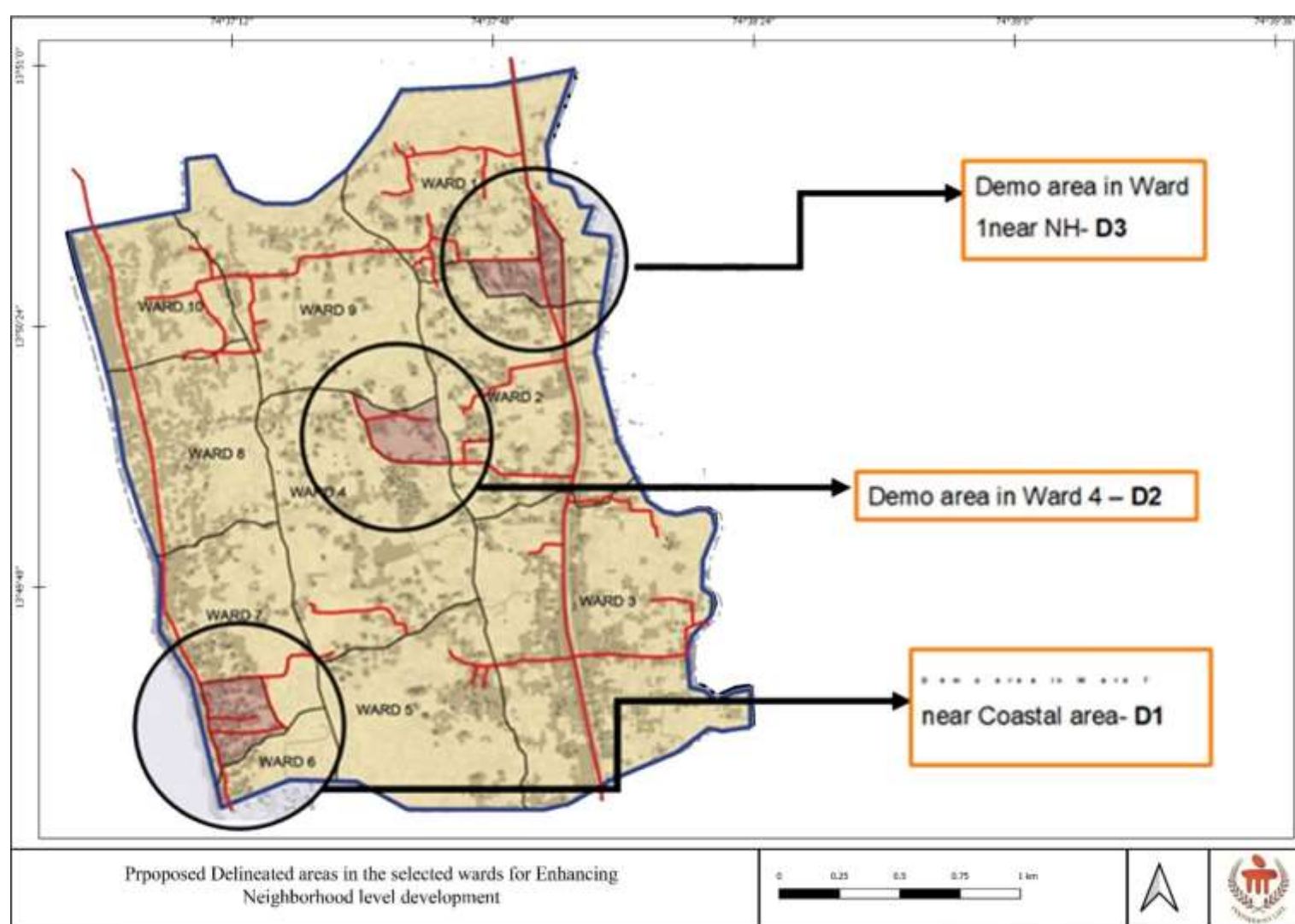


Figure 9-51 Map with selected areas for Demo proposals
(Map Source: NRSC, MSAP)



9.18.1.General Characteristics

I. Area near coast (ward 7)- D1

- High population density – 268 people
- (Dense cluster of housing)
- Waste dumped in empty plots
- Water entering the houses during rainy season
- House are dilapidated condition

II. Ward between the coastline and near NH (ward 4)- D2

- Has higher density compared to other wards situated in the centre of village (ward – 9 and 5)
- No waste disposal or collection by the panchayat or municipality
- The route that connects the demo area from NH
- No alternate source of water when wells dries up during summer season

III. Area near NH- D3

- Dense housing
- The area demarcated is just next to the NH
- Close to Durga Parameshawari Temple
- Open waste dumping and compost of waste is seen.

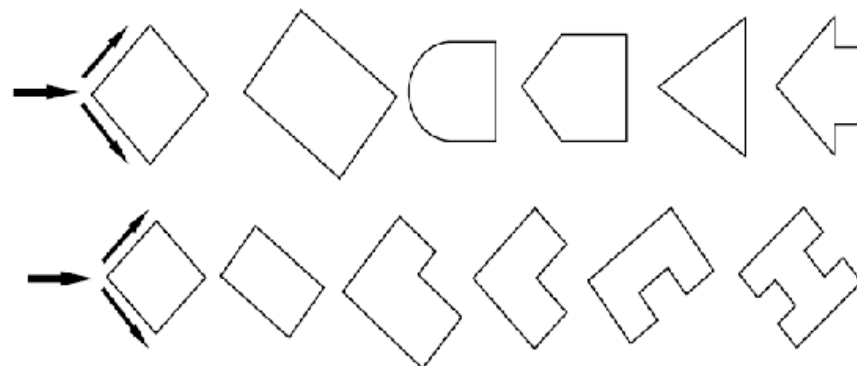


Figure 9-52 recommended shapes and forms to resist the wind

9.18.2.Proposed guidelines

Proposal for D1 (Near Coast):

The rural homesteads follow a courtyard layout where the layout is introverted, that is, the buildings face away from the outside and are accessed through the courtyard. Entry into the compound from the outside is through gaps between buildings.

The homestead is extensively planted with trees along the boundary and strengthens the introverted layout.

Orientation: Correct orientation of the building reduces wind and wave pressure as angles cut the flow

Building Form: Flat or low-sloped porch roofs, overhangs, and gable ends are subject to increased uplift in high winds. Buildings that are both tall and narrow are subject to overturning. In the design process, choosing moderate-sloped hip roofs is advisable

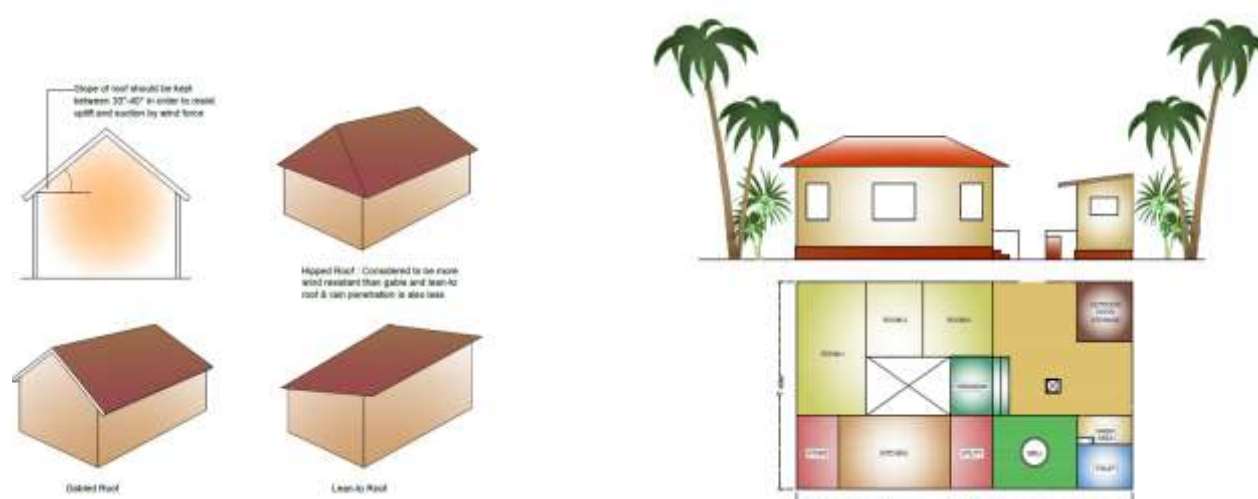


Figure 9-53 layout of typical dwelling

Proposal for D3 (Near NH-66):

Study says that residences near the NH are well-built and sturdier, using materials such as laterite bricks for the walls which are then plastered and Mangalore tiles for roofing. Toilets are hardly located separate from the main structure. The layout is not specifically introverted, although the buildings are built within a compound wall, marking out the plot area precisely.

It is required to provide safety and security to those dwelling units situated next to NH as shown in Figure 8.50.

- Height constraints do not permit the building to go beyond 9mts, i.e. G+2 structures.
- With the option to go higher, residences have the option of constructing and even renting out the higher stories in the future. For such a scenario, having an external staircase to reach the higher floors is essential. Due to the close proximity to NH, to reduce the noise and air pollution local plantation is required.

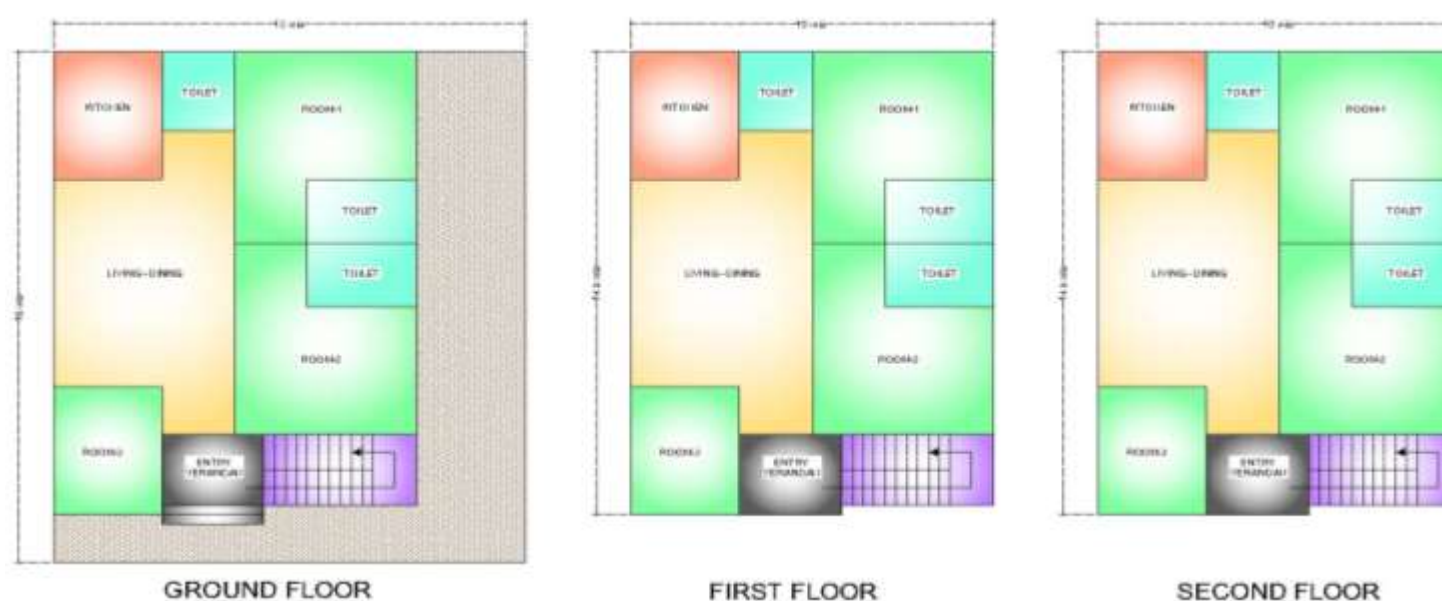
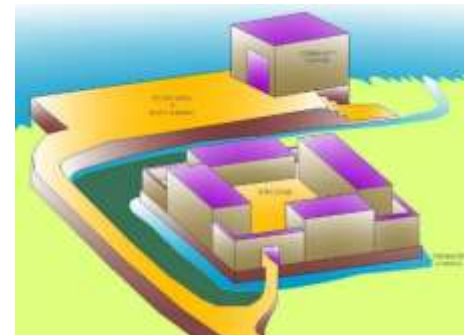
9.18.3. Design aspects for floods**Proposal**

Figure 9-54 : Conceptual sketch of layout of a typical dwelling near the NH 66

The central part of each dwelling units (or plot) should be its highest point, sloping gently (1% minimum slope) to the edges to allow drainage. Drainage channels connected to nearby water bodies should be created to prevent stagnation of water within the house plots. Keeping a small supply of old blocks/bricks at handy in case they need to be used as steppingstones to connect the separate structures within the same plot in case of water-logging. Main entry into the compound should be raised to allow access during flood times. A possible raised area for shelter to provide flood relief to the people.



Conceptual sketch for low lying areas

Figure 9-55 Typical settlement design aspects for low lying area

9.18.4. Design Consideration for Plinth

Proposal for Cement -Stabilization

A cement-stabilized plinth resists water much better than an un-stabilized one (Figure 8.62). Capping the plinth with cement stabilized earth is cheaper, easier to construct and maintain. Stabilization of the typical earthen plinth can be carried out with a mixture of earth and cement. The proportion of cement to be added depends on the nature of the soil, which can easily be tested on site. For soil with more than 40% sandy-silty particles, 5% cement additive is adequate, whereas for soil with less sandy content, sand has to be added to raise the content above 40% and may require a somewhat higher proportion of cement additive. Test blocks should be made on site to determine the suitability and proportions of the mixture.

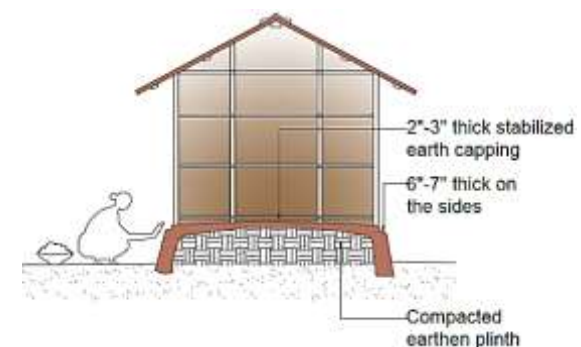


Figure 9-56 Details of cement-stabilized plinth

Proposal for Brick Perimeter Wall

A brick perimeter wall around the typical earthen plinth resists erosion from the sides (Figure 8.63). If soil is too weak or loose, the foundation of the perimeter wall should penetrate to sufficient depth, preferably with a spread footing. Since very little load is imposed on the wall, the footing can be constructed with brick without the need for a concrete footing. Minimum 1:4 cement-sand mix should be used. Soil cover on the foundation should be thoroughly compacted and should preferably have plant or grassy cover to prevent scouring during flood. Infill should be of cement-stabilized soil to prevent muddiness, settlement due to saturation and loss of soil from below.

Proposal for Brick & Concrete Plinth

This is a relatively expensive option, but more durable and flood-resistant (Figure 8.64). Should properly compact sub-base soil to avoid settlement. If necessary, can provide a layer of sand filling. If soil is too weak or loose, a layer of brick soling should be provided. Soil cover on the foundation should be thoroughly compacted and should preferably have plant or grassy cover to prevent scouring during flood. Composition of Cement Concrete:

- 4 inch cement concrete base slab @ 1:5:10 = cement : sand : aggregate (brick chips, 1½ inch nominal size).
- 1 inch cement concrete topping @ 1:2:4 = cement : sand : aggregate (fine brick chips).



Figure 9-57 Brick plinth construction.

9.18.5. Rainwater Harvesting in Household Level

Proposal for Cement -Stabilization

In rural areas: House roofs are usually built with sheets or tiles. Here, rainwater comes to the edges easily and hence water can be collected through gutters. People can make use of fine cloth material to filter the rainwater from the roof. Here, collected water can be used to store water either for domestic use, livestock, or for agricultural needs (Figure 8.65 (a))

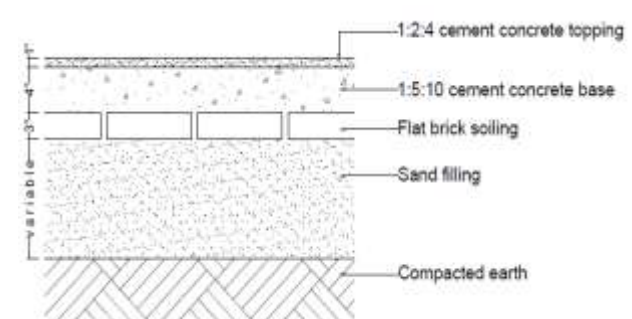


Figure 9-58 Cement concrete flooring detail

In Urban areas: Here, rainwater from the house roof is collected through rainwater gutters and stored in a storage tank. The system is designed to support both potable and non-potable needs of the family at their doorstep. Rooftop rainwater harvesting for recharging groundwater is a common practice implemented in individual houses (Figure 8.65 (b))

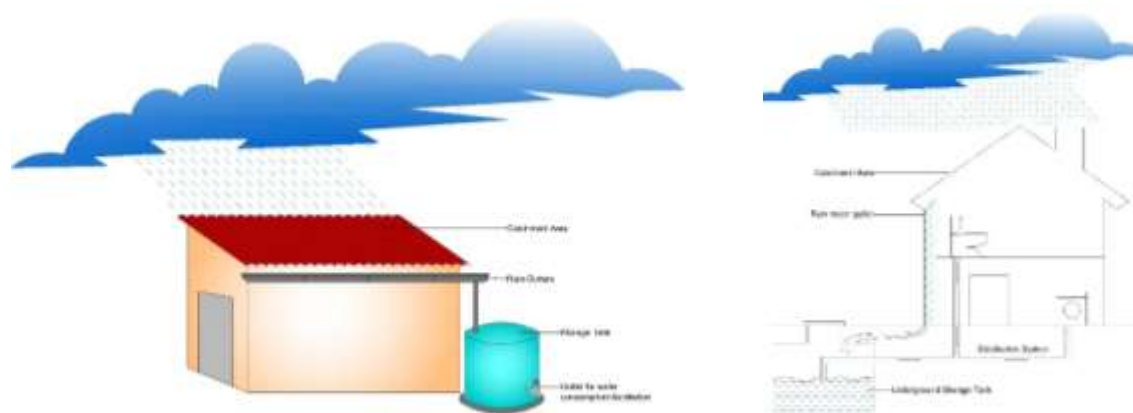


Figure 9-59 Rooftop rain water harvesting for rural households

End use of harvested rainwater at Homes: Garden/lawn irrigation, toilet flushing, clothes washing, car washing, showering/bathing, and even for drinking (by using water treatment methods). Rainwater harvesting for house systems (Rural model and Urban model) comprises some basic components and are as follows:

- I. A catchment area: Rooftop of the house will be the area to capture rainfall.
- II. A conveyance system: To move the captured rainwater from the roof to a storage area (maybe piping).
- III. A storage system: To hold the rainwater for future use — a barrel, a cistern or a tank.
- IV. A distribution system: To get the water from storage to where it is being used.

9.19. Water Management

An estimated 85% of all water withdrawals (from streams, rivers or aquifers) go for irrigating agriculture. (KJA, 2019) And yet majority of the farmers do not have irrigation or are seeing their borewells run dry as groundwater declines. Therefore, sustainability of water resources and of farmer livelihoods, combined policy shifts in both the agriculture sector, the water sector and the electricity sector will be required without a drastic reduction in the demand for water in this sector as a whole and better distribution within the sector, there will just not be enough water for the domestic needs of the people of the State, or for sustaining farming in the future.

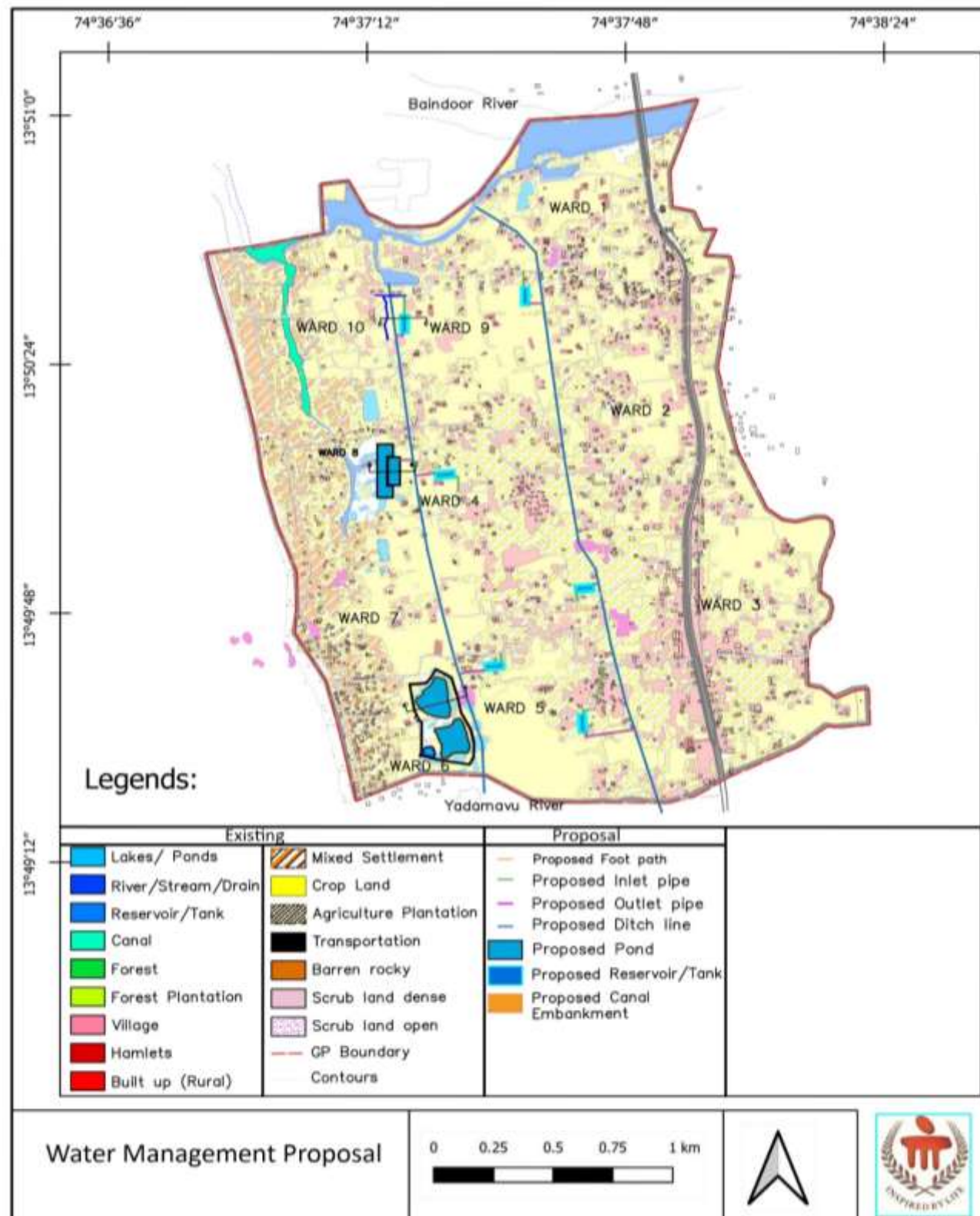


Figure 9-60 Proposed map for Water Management at Uppunda

9.19.1. Water Retention Pond

Stormwater drainage is provided to channelize the excess runoff water to reduce stagnation for low lying area and to harvest it. Drainage is laid according to the road layout. This further connected to the Water retention ponds that are provided in the low area of ward 4,5,9 as demarcated by blue rectangle (Figure 8.66) These are of 1000sq.m of area. With the help of this we can collect the run-off water collected from the road. Below is the section showing the depth and layout of retention pond.

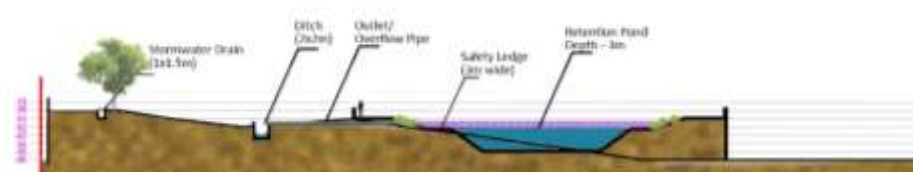


Figure 9-61 plan and section of water retention pond

9.19.2. Herringbone Drainage Pattern

Herringbone drainage pattern is the most common and widespread pattern to be found on the earth's surface. It is associated with horizontal or very gentle topographic surface having extremely low reliefs. Thus, it is suitable in the case of Uppunda. The Herringbone system is the design for the main central pipe. The pipe runs down a slope with numerous lateral pipes connecting to it. This design does not require as much depth for excavated drains compared to other options that are available. This can be laid along the slope of ward 1,2,3, 6,7,8,10 as marked in blue. (Figure 8.69) This will further carry out to the main pipe line (ditch line) which will run north-south of ward 4,5 and 9 on both sides connecting to the Baindur and Yadamavu river.

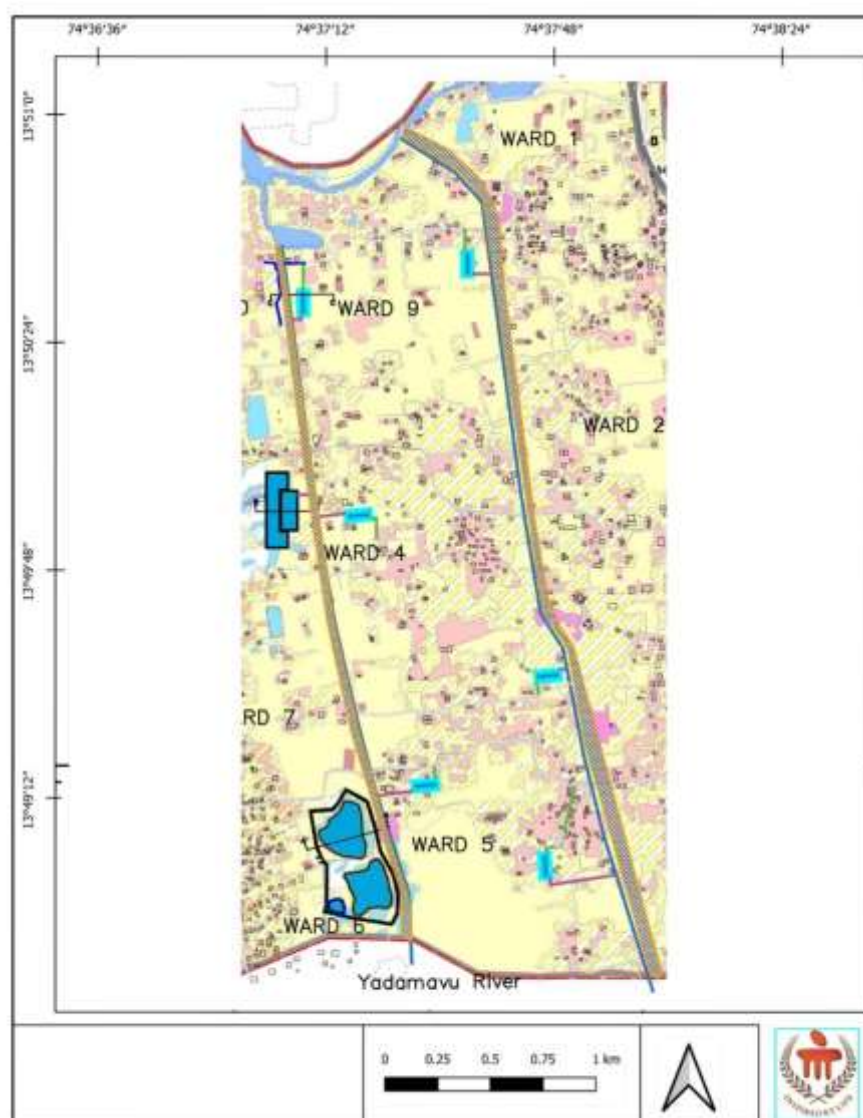
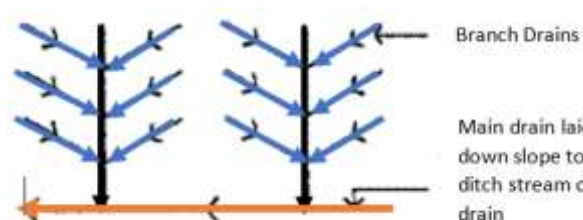


Figure 9-62 Herringbone Drainage Pattern & Uppunda Map showing Layout of Proposed Herringbone drainage

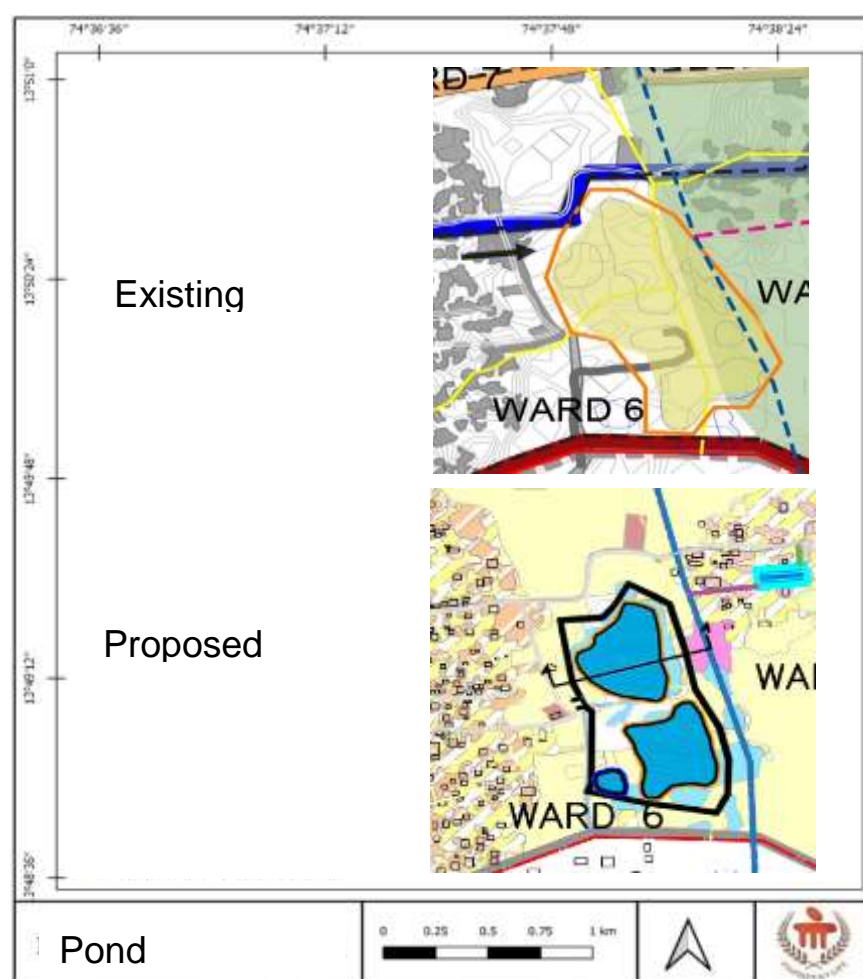


Figure 9-63 a): Plan of Pond Area, Source - Data source: NRSC, Map generation - Site survey team, MSAP, (b) Pond Enlargement plan, (Source – Aman)



9.20. Solar Distillation

On an individual level, Solar distillation to be provided to desalinate water and for further use it for domestic purpose. Solar water distillation is the process of using energy from the sunlight to separate freshwater from salts or other contaminants. The untreated water absorbs heat, slowly reaching high temperatures. The heat causes the water to evaporate, cool, and condense into vapour, leaving the contaminants behind. Solar stills can be used for low capacity and self-reliant water supplying systems. This can be used in all the wards as it is a small-scale operation.

9.20.1. Canal Embankment

Other than that, protecting canal and other small pond by maintaining embankments or canal walls to protect from sea water intrusion along the ward 8, 10. Canal is provided with a height of 2.4 m above the ground with a 1 m freeboard and a crest of 1.5 m. In this, wet side, a gentle slope of 2:1 is provided to reduce the damage. Whereas in dry side, slope of 1.5:1 is provided. Further cut off trench is provided to reduce the seepage outside and ditch is provided in case of overflow of water.

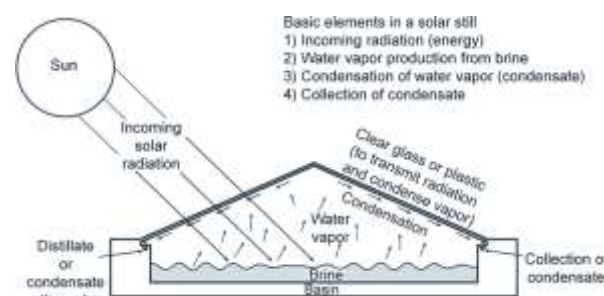


Figure 9-64 Solar Distillation Process, Source – Waster water Engineering: Treatment and Reuse

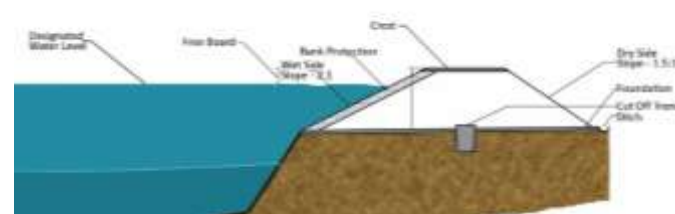


Figure 9-65 Canal Embankment Section, (Source:Aman)

9.20.2. Pond Enlargement

In Uppunda, the small water bodies which are present around ward 5, 6, 7 and 8 can be clubbed and made into a bigger pond which will not only provide water to the wards but also will be a recreational space for the residents living there as there is no connectivity of water and high amount salinity is seen in those wards as it is nearer to the coast.

9.21. Waste Managements

To propose a holistic solution for the system to manage waste in terms of the waste collection and segregation and disposal in Uppunda. The following proposals has been updated in master plan as shown in Waste Management Map.

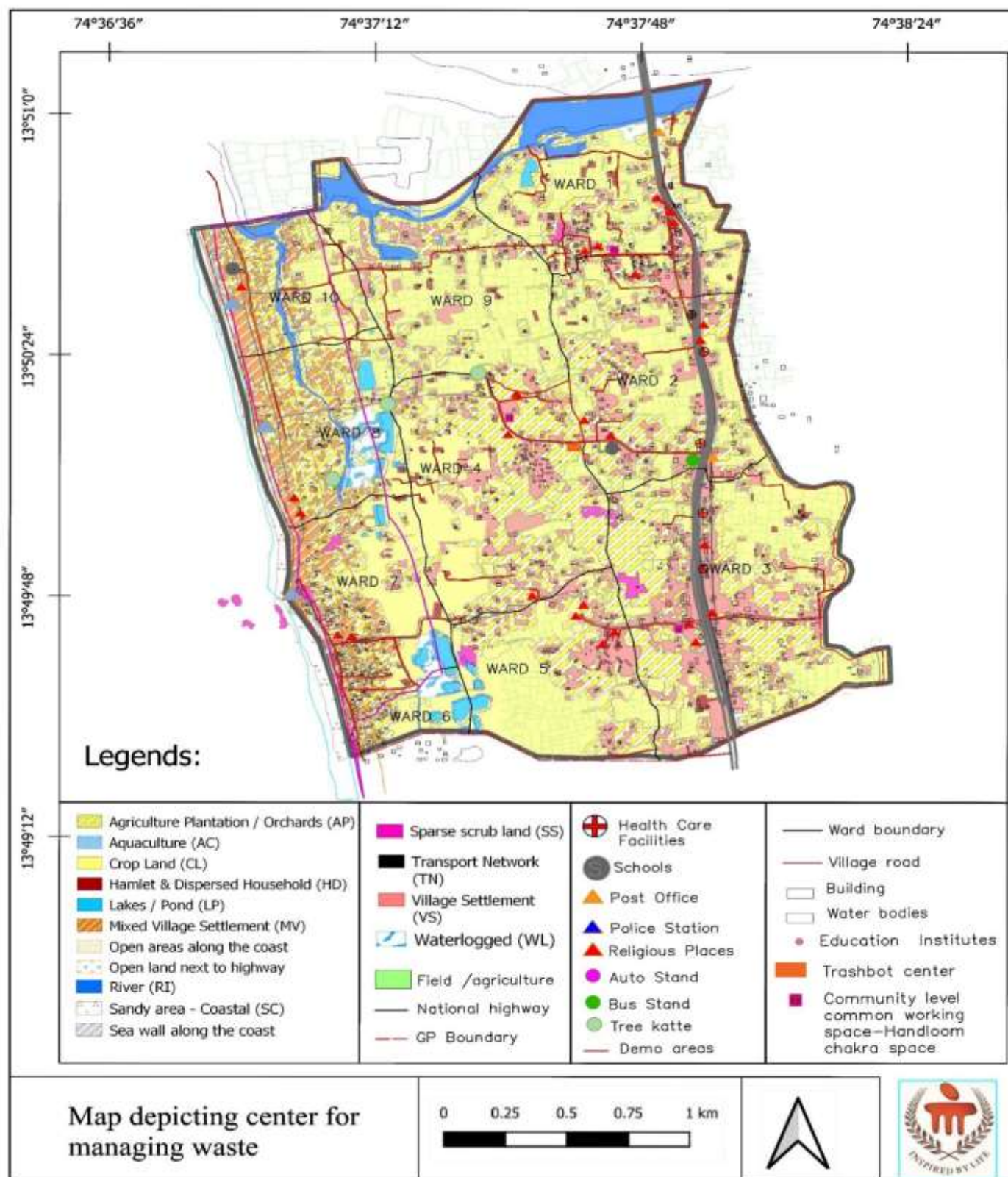


Figure 9-66 Proposed Map Depicting Center for Managing Waste at Uppunda

9.21.1.Holistic Waste Collection System

- From the report, (shetty, 2012) the quantity of biodegradable waste generated at the household is 500 to 750 grams per house; on approximating it, almost 600 grams of bio-degradable waste is considered to be generated. The waste collection bins are available at varied capacity with respect to the population, the generated amount of waste from one dwelling unit
- and the regular interval at which the waste collector collects the waste at the household level, from the community bins decides the capacity of the bin that can be equipped at the community level for managing the waste which are not digested at the compost technique at household level.



- The biodegradable waste is transformed into compost at the household level, which is not harmful for the environment, but the non-biodegradable waste that cannot be recycled is crushed and made into other products for re-utilization. In this way the thin plastics, crates and buckets is not taken aback to the environment which is not eco-friendly instead harms the place it is littered at. At the place where these wastes are generated must be stopped and the eco-friendly materials are supposed to be utilized as alternative material. Collecting the waste at the shopkeeper level by providing incentives, or the waste that are non-recyclable are given to waste collector for money, that is, either the waste collector or the people following get the incentive.
- The existing condition of Uppunda (Figure 7.21), that was found in the issue identification, the waste being littered at the empty plots, natural course of water and the waste that are burnt at the household level, has to be addressed to tame a holistic solution for the system to manage waste. In this case a hierarchical model that supports the process of the waste management system in Uppunda is proposed.



Household	Segregation, collection
Community	Segregation, collection
Villages	Segregation, collection and processing
Gram panchayat	Processing, transportation

The similar hierarchy of waste management system can be followed.
Source: Guidelines on Solid and Liquid Waste Management in Rural Areas, Ministry of drinking and sanitation

Figure 9-67 Segregation of Solid Waste

- The hierarchy of the system as shown in Figure 8.75, must be followed in Uppunda. The structure which makes it more organized in terms of the waste collection and segregation. In general, there are varied capacity of the community level bins which starts from 120 liters and ranging above 1000 liters, but the village will require 150

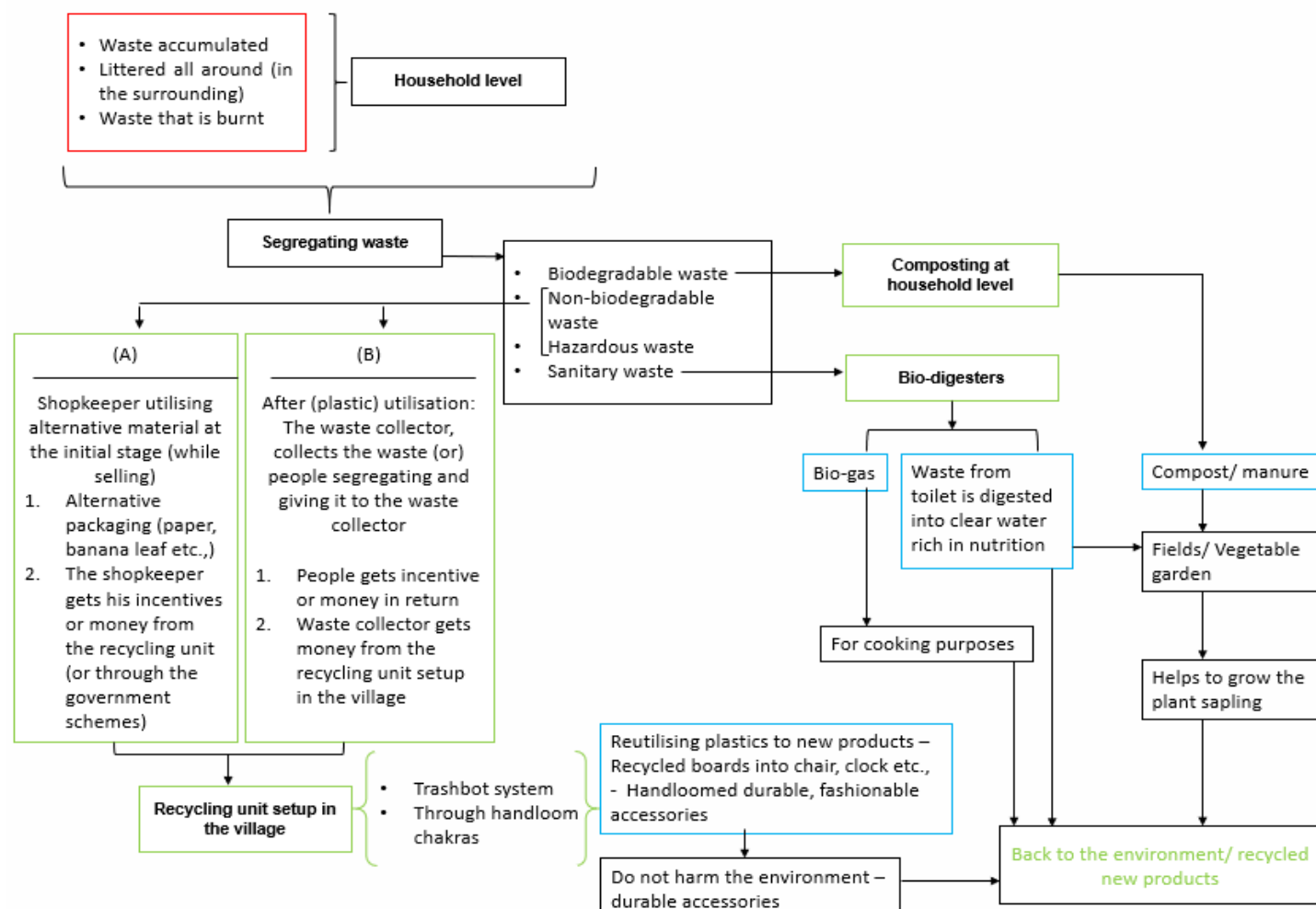


Figure 9-68 The holistic management system that can be incorporated in Uppunda

liters of waste collecting bin at each cluster level. It is best to have a collective system of waste management, starting from each dwelling unit, intervening at community level, and considering the overall management of the village. At the household level instead of throwing the waste at the nearby empty plots (or) incinerating the waste (or) dumping the waste in the natural water course, the waste can be compost, also, the kitchen waste (wet or dry) can be utilized as manure for plantation.

- The flow chart represents the holistic model of how the waste can be managed from the household level through various technology and strategical structure at Uppunda. The stage one is to segregate the waste at the household level; those waste that is littered around, the waste that is burnt must be retained without burning for segregation. In stage two upon segregation, the wastes are classified to biodegradable waste, non-biodegradable waste, hazardous waste, and sanitary waste. Here biodegradable wastes are taken to composting at household level, this compost/ manure is used in the agricultural fields or vegetable garden which supplements the nutritive value to the soil to grow plants and is giving back to the environment.
- The second category of the non-biodegradable waste and hazardous wastes are split into two stages, one is at the initial stage were the shopkeeper himself manages an alternative package material without using plastics; second, after utilizing the plastics, the waste is collected from all the households at community level with some monetary value by the waste collector; in both these cases either the shopkeeper or the waste collector gives the waste collected to the recycling unit setup at the village level, that is to the trashbot system or to the system at which the fashionable accessories made through handloom chakras. Thus, in these two systems either the recycled board that can be used for chairs clock etc., is manufactured into new products or fashionable accessories are made through the handloom chakra system and contributes to the environment by not remaining as a harmful substance instead recycled into new products.
- The third category is the sanitary waste, here the waste from the toilet is connected to the bio-digesters. The processes at which the system operates, as the digesters digests the waste, leaves the gas and the water through the outlet. The biogas is utilized for cooking and the water is sent to the field and the garden to supplement the soil with further nutritive content. Thus, the third stage also gives back to the environment in acting as a supportive catalyst in the growth of the plant.

9.21.2. Composting

- Composting the waste in pit is more like the box composting. As the village inherent rainfall mostly, this must be covered. All the waste material is put into the pit, broken down into small pieces. These compost pits are made in each household, because of this very smaller unit of composting is delt at each household which lead to faster pace in decomposing the waste.

- Composting is a very cost-effective process that involves waste material decomposed to get fertilisers for the field and vegetable garden. This can be equipped in Uppunda at the household level itself, there are three pits that should be dug to. In the first pit organic matter is layered till it reaches the ground level.

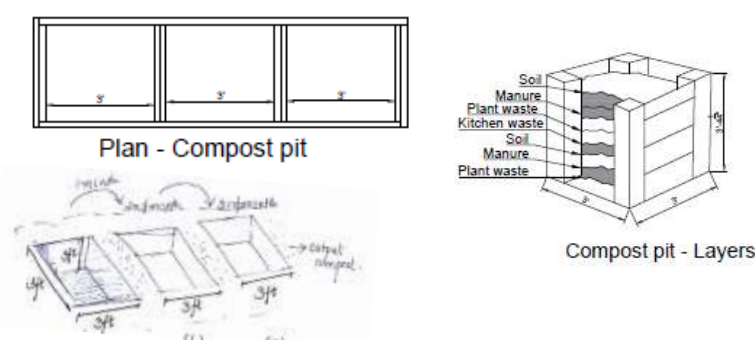


Figure 9-69 The compost pit (1) The initial stage in the first month (2) Second stage from the pit 1 to pit 2 in the second month (3) The final stage, from pit 2 to pit 3; finally the compost is prepared.

- From pit-1 the waste material is dumped into the second pit, after one month, in the similar way the waste material from the pit – 2 is shifted to the third pit in the third month. The third pit gives fully finished compost which can be used in the fields. The pit or the container should be at similar measurement, **3 feet wide* 3 feet deep* 3 feet long** to bring its maximum efficacy (Figure 9-67). If it is a container then it must be aerated else the

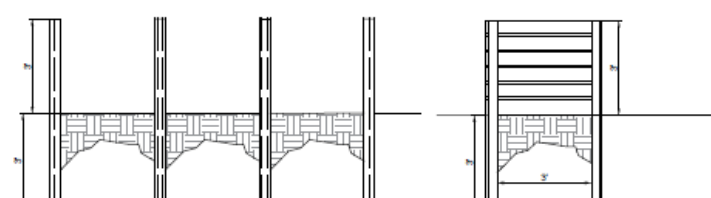


Figure 9-70 The arranged layer in the box compost, the box compost has to be arranged in the same way the pit compost is made (2) The roof covering for the box compost so that they are not affected by direct (climatic conditions) sun/ rain.



pile starts emitting unpleasant odour, to avoid getting directly hit by sun and the rains these can be protected with the roof.

- To be equipped in Uppunda; the backyards of the houses can be chosen. Specifically, when it is a container it must be aerated and in both cases of box compost or pit compost it should have a cover, also should have a roof because of the rains. The roof should be angled so that the rainwater does not directly hit the compost pit. It should be made in such a way that these roofs are easily assembled and can also be disassembled.



The plan of the Trashbot Center; (waste collection and segregating zone representation, Source: (Hesperian health guide - A community trash work, n.d.))

9.21.3. Trashbot at Site Level

Upon managing the solid waste, segregating the waste is a major concern, so as to ease this, the invention of the trashbot that proved to segregate waste even when the waste contains mixed materials, that is, plastics mixed with food particles, batteries etc. This is segregated with respect to biodegradable and non-biodegradable wastes. As the segregation is done within the system the biodegradable waste that is digested to produce biogas and manure; whereas the non-biodegradable waste is made into recycled boards which is then converted to chairs, table, even partition walls to be reused (Trashbot by Nivedha - The waste segregator is currently available in four capacities— 500 kg, two tonnes, five tonnes and ten tonnes. By: ARANHA, JOVITA, 2019).

- This trashbot is available at varied capacity, we can choose according to the capacity of waste generated in the village. As mentioned in the report (shetty, 2012) the biodegradable waste per household is *600 grams which is 0.6 kg*. In Uppunda total number of households is 2,167 cumulatively approximating the total waste generated from all house is *1,300 kg/ day*. The varied capacity at which the trashbots are available is **2 TPD/ 5 TPD/ 10 TPD/ 25 TPD**. To cater to the waste generated 2 ton per day capacity is enough to make the waste material to recycle boards. This also generates job opportunity for the village.
- For Uppunda the starting capacitive system can be bought one-time investment of 9 lakh rupees that can solve almost all the solid waste management issues in here. A **trashbot of 500 kg -10 TPD requires 150 sq feet** for the machinery to be spaced within. This can be spaced near the community level interactive zone, also should be located at the center of the site so that the commutation is much easier. So, on selecting the zone for the “Trashbot Center” to be spaced suits the demo area at ward 4 area as it is located in the center of the village and is at easy reach to all the people at the village. This also, has direct connectivity to the highway.
- The plan depicts that when the trashbot center is entered it is spaced with the segregating space for waste and the storage unit for recycle boards. The machinery is placed inside, also the space is constructed with the sheets there is two opening for easy access on loading the waste.

9.21.4. Thin Plastic Converted to Plastic Bags

- On relating to the best practices that was followed in Uttar Pradesh of shredding the plastic into thin strips of plastics and is made into new fashionable products. The similar technique must be formed in Uppunda to recycle the plastic waste and create a community workspace for the people at the village to handle, maintain the handloom chakras. This also creates job opportunity for the villagers as like the trashbot center.
- Upcycling of the handloom chakras can be incorporated to weave and tailor the newly made fashionable accessories, this can be accommodated in the space where the community interactive working zone is spaced. Only to accommodate the machineries at the community level space creates a pattern of converting all the waste material to handloomed products at the community level.

Figure 9-71 Detail of Trashbot Center in Ward

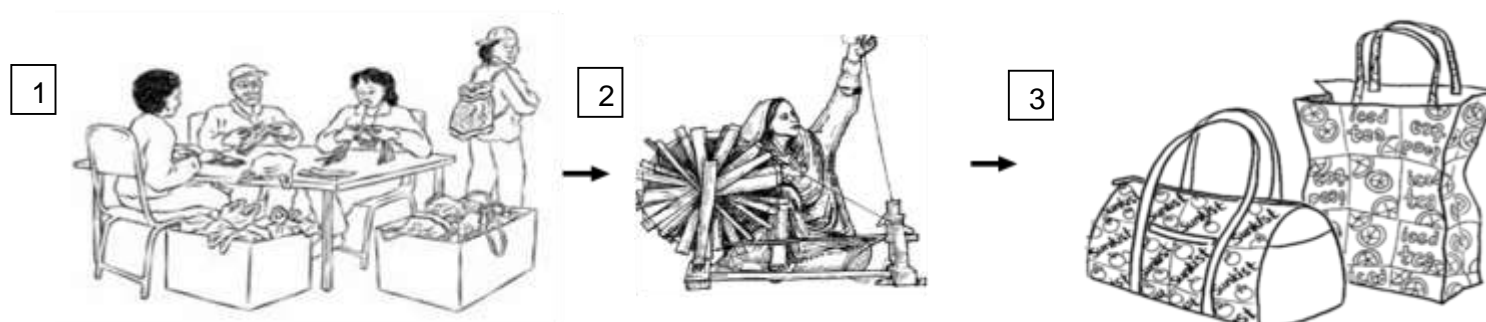
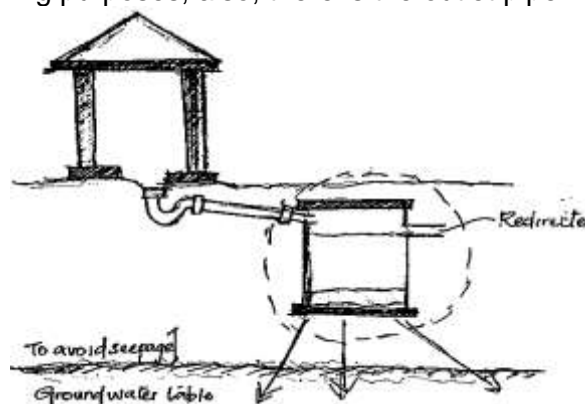


Figure 9-72 (1)Community level working space, source: (Getdrawings, n.d.) (2) Handloom chakra with which they weave the shredded plastics , source: (Asia inch thinkers, creators, makers, doers, 2018)(3) New products – fashionable accessories is formed, source: (Hesperian health guide - A community trash work, n.d.)

9.21.5.Bio- Digester

- The biodigester are must to be incorporated in Uppunda because the ground water table is high and the waste that is generated can be digested, utilized for the environment in an effective way. Figure 8.83 depicts the distance between the digester and the groundwater level. This space has to be maintained to not allow the seepage of grey water into the ground water table because of the porous nature of the sandy soil that prevail in the village. The characteristics of the soil and the high groundwater level is the important reason to have incorporate this system in Uppunda.
- According to the capacity of the bio-digester the chambers can be increased or decreased, also, the size can vary. These waste when digested, forms biogas which can be used for cooking purposes, also, there is the outlet pipeline through which the water that contains nutrition, after all the harmful material is digested by the inoculum bacteria in the chamber. The water is used in fields and the gardens nearby. This collective system of treating even the toilet waste, shows an overall picture how the waste in each category given back to the environment without harming them.
- The bio digesters will have some strategies to be followed, when its installed to the toilets:



- In the toilets acid should not be used to clean, as it might destroy the inoculum bacteria that acts as digests the faecal matter.
- The outlet water is supplied to the vegetable garden or the agricultural field as it contains nutritive value and is an supplement for the plant sapling to grow.

Figure 9-73 Schematic representation - toilets connected to the inlet of the bio-digester, representing the gap from the ground water table.

- The water from the outlet pipe can be taken to the agricultural field, to the soak pits were the canna indica is also present to even break down the soap water or can even take to the nearby community vegetable gardens this be the catalyst by giving back to the environment. The bio-digesters are of low maintenance, it can come for longer run if the washing with acid and harmful chemical are not done, as the inoculum bacteria nurture on digesting the waste.

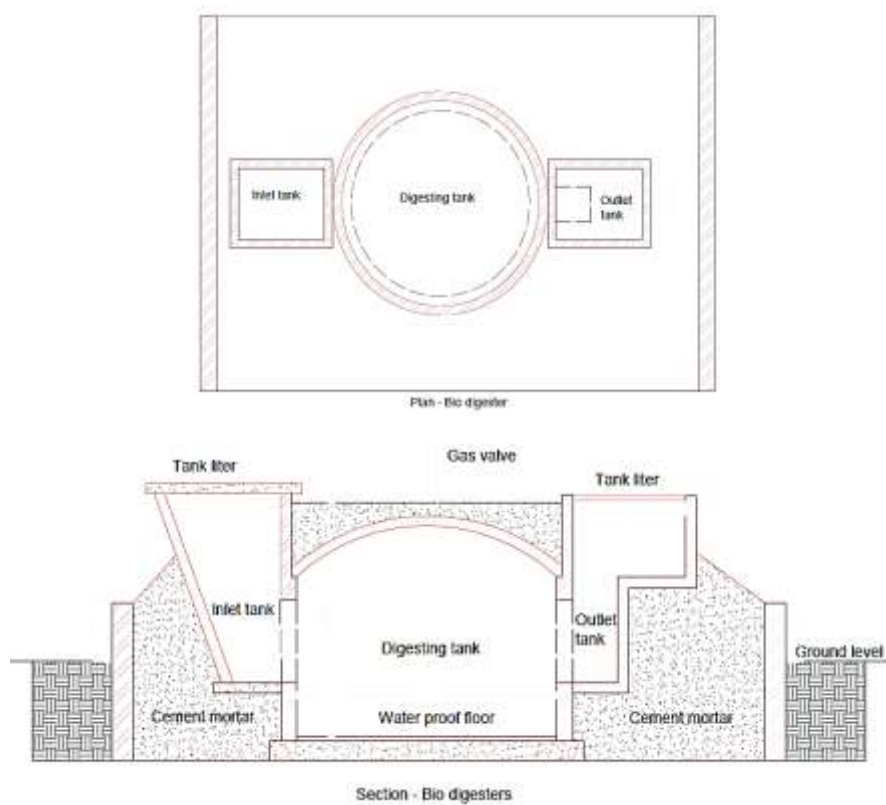


Figure 9-75 Detail of Proposed Bio- Digester

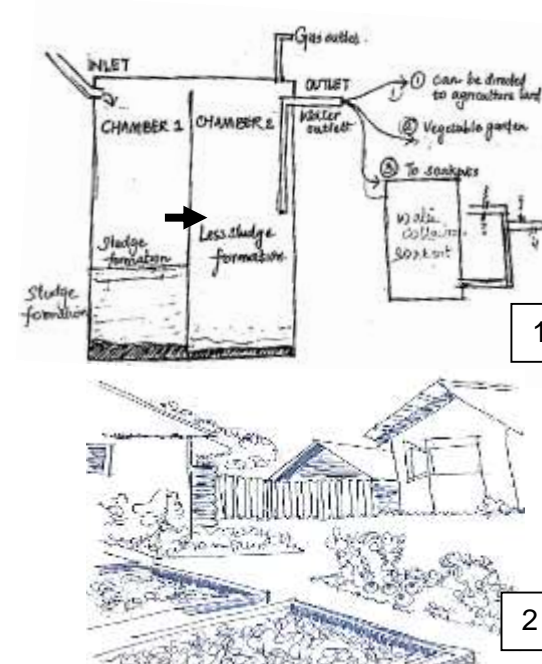


Figure 9-74 (1)The bio-digesters are reduced to 2 chambers with respect to the capacity; (2) The water from the outlet is directed to the garden and agricultural land

9.21.6. Shrimp Farming

Chicken waste and other meat wastes in great quantity is being dumped into the rivers at the bridges affecting the CRZ zones around it. The waste should be collected at source and should be sent for seasoning, making it suitable for pets feed.

As an alternative the can also be utilized for shrimp farming as a supplementary feeding. Which can be implemented in the CRZ

zones itself as Shrimp farming is already being practiced there.

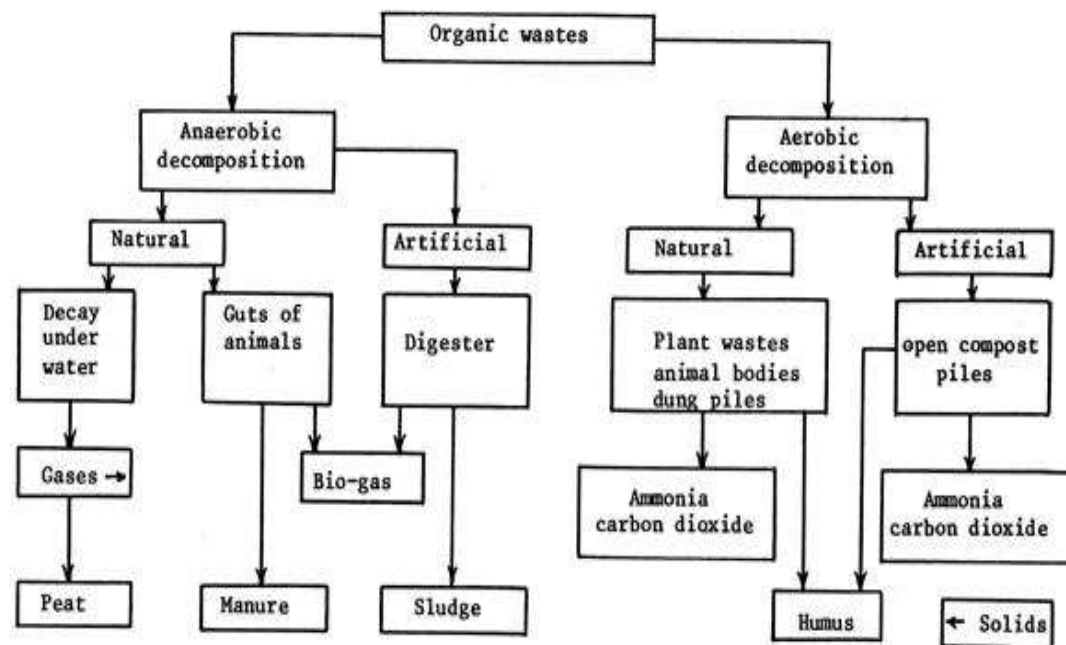


Figure 9-76 End products of organic decay

10. References

- (Globally, 1992; GOI, 2014; Indira & Anupama, 2016; Jovovic et al., 2017; Khajehzadeh et al., 2016; Mills, 2006; Moles et al., 2006; Moresová et al., 2020; Onwuanyi & Oyetunji, 2016; Papers, 2005; Patra, 2016; S.Sharma, n.d.; Setijanti et al., 2015; Shaji & Kini, 2016; Sholihah & Heath, 2016; Study et al., 2020; Thadani, 2011; United Nations - Department of Economic and Social Affairs, 2013, n.d.)Globally, R. (1992). *Why resilience in cities?*
- GOI. (2014). Press Information Bureau Government Of India. *Goi2014, April, 23389338*. <https://pib.gov.in/newsite/mbereel.aspx?Relid=159082>
- Indira, C. G., & Anupama, V. (2016). The Smart Villages : The Real Future Of Emerging India. *International Journal of Innovative Research in Advanced Engineering (IJIRAE)*, 3(12), 29–31.
- Jovovic, R., Draskovic, M., Delibasic, M., & Jovovic, M. (2017). The concept of sustainable regional development – institutional aspects, policies and prospects. *Journal of International Studies*, 10(1), 255–266. <https://doi.org/10.14254/2071-8330.2017/10-1/18>
- Khajehzadeh, I., Vale, B., & Yavari, F. (2016). A comparison of the traditional use of court houses in two cities. *International Journal of Sustainable Built Environment*, 5(2), 470–483. <https://doi.org/10.1016/j.ijbsbe.2016.05.010>
- Mills, G. (2006). Progress toward sustainable settlements: A role for urban climatology. *Theoretical and Applied Climatology*, 84(1–3), 69–76. <https://doi.org/10.1007/s00704-005-0145-0>
- Moles, R., Kelly, R., O'Regan, B., Ravetz, J., & mcevoy, D. (2006). *Methodologies for the estimation of sustainable settlement size*.
- Moresová, M., Sedláčiková, M., Schmidtová, J., & Hajdúchová, I. (2020). Green development in the construction of family houses in urban and rural settlements in Slovakia. *Sustainability (Switzerland)*, 12(11), 1–17. <https://doi.org/10.3390/su12114432>
- Onwuanyi, N., & Oyetunji, A. K. (2016). Revitalizing Nigeria's built heritage using Facility Management service delivery: The Lagos National Arts Theatre Complex. *International Journal of Sustainable Built Environment*, 5(2), 579–586. <https://doi.org/10.1016/j.ijbsbe.2016.05.001>
- Papers, U. D. (2005). Promoting Sustainable Human Settlements and Eco-City Planning Approach: Southeastern Anatolia Region and Southeastern Anatolia Project (Gap) in Turkey As a Case Study. *Promoting Sustainable Human Settlements and Eco-City Planning Approach: Southeastern Anatolia Region and Southeastern Anatolia Project (Gap) in Turkey As a Case Study*, 7, 1–19. https://doi.org/10.5209/rev_UNIS.2005.n7.29360
- Patra, R. T. (2016). *Town Planning in Ancient India : In Moral Perspective THE INTERNATIONAL JOURNAL OF HUMANITIES & SOCIAL STUDIES Town Planning in Ancient India : In Moral Perspective. September.*
- S.Sharma. (n.d.). *City Region in India: Meaning, Distance, Nature and other details*.
- Setijanti, P., Defiana, I., Setyawan, W., Silas, J., Firmaningtyas, S., & Ernawati, R. (2015). Traditional Settlement Livability in Creating Sustainable Living. *Procedia - Social and Behavioral Sciences*, 179, 204–211. <https://doi.org/10.1016/j.sbspro.2015.02.423>
- Shaji, L. S., & Kini, M. K. (2016). Contextual Form Based Coding as a Tool in Urban Design Process-chalai, Thiruvananthapuram as a Case. *Procedia Technology*, 24, 1714–1725. <https://doi.org/10.1016/j.protcy.2016.05.204>
- Sholihah, A. B., & Heath, T. (2016). Assessing the Quality of Traditional Street in Indonesia: A case study of Pasar Baru Street. *Procedia - Social and Behavioral Sciences*, 234, 244–254. <https://doi.org/10.1016/j.sbspro.2016.10.240>
- Study, N., Panchayat, B., Literature, S., Resources, E., Week, N., & Perpetration, G. I. S. L. (2020). *Environmental Resources. 1*.
- Thadani, D. (2011). *"The future of India lies in its villages."* <https://www.planetizen.com/node/50694>
- United Nations - Department of Economic and Social Affairs. (2013). Chapter III: Towards sustainable cities. *World Economic and Social Survey 2013*, 53–84.
- Gadgil, M., Chakravarthy, A. K., Chandrashekariah, H. N., Gadagkar, G., & Shankar, G. (n.d.). *Karnataka State of Environment Report and Action Plan Environmental Information System (ENVIS) Indian Institute of*



Science. 04(December 2004).

- Plan, C., Coastal, O. F., & Zone, R. (2012). *Report Comprehensive Plan of Coastal Regulation Zone in*. 80.
- Ramachandran, C., & Sunil Mohamed, K. (2015). Responsible Fisheries Operations. *Economic & Political Weekly*, L(35), 16–18.
- <https://www.culturalsurvival.org/publications/cultural-survival-quarterly/fishing-resources-indian-fisheries-danger>
- <https://karunadu.karnataka.gov.in/kbb/english/Pages/Fishes-of-Karnataka.aspx>
- <https://www.deccanherald.com/opinion/main-article/marine-species-in-danger-729977.html>
- <https://www.jstor.org/stable/4396716?Seq=1>
- <https://qz.com/india/1804562/for-indias-karnataka-fishermen-climate-changes-just-barren-sea/>
- <http://shodhganga.inflibnet.ac.in:8080/jspui/handle/10603/198017?Mode=full>
- <https://www.culturalsurvival.org/publications/cultural-survival-quarterly/fishing-resources-indian-fisheries-danger>
- FAO- Code of Conduct for Responsible Fisheries, FAO Corporate Document Repository, Fisheries and Aquaculture Division, FAO.
- www.fao.org/docrep/005/v9878e
- <http://www.fao.org/3/v9878e/v9878e00.htm>
- <https://en.gaonconnection.com/fisheries-ministry-reduces-annual-fishing-ban-by-two-weeks-fishers-forum-calls-it-unscientific-and-demands-its-revocation/>
- <https://indianfisheries.icsf.net/en/page/614-Fisheries%20Development%20and%20Management.html>
- <https://www.policycircle.org/life/addressing-livelihood-issues-of-fisherfolk-during-seasonal-fishing-ban/>
- <https://scroll.in/article/811570/how-goans-get-around-a-monsoon-ban-on-fishing-and-its-legal-and-environmentally-friendly-too>
- Marine spatial planning for resource conservation, fisheries management by Dineshababu, A. P.
- Small-scale Cage Culture of Asian Seabass in Kundapur Region , Ail, Sunil Kumar S Bhatta, Ramachandra
- Efficacy of spatial study on catch and effort from fishing vessels for strengthening fisheries management by Dineshababu, A. P.
- ENVIS center, Ministry of environment and forest, govt. Of india
- <http://hdl.handle.net/10603/152831>
- 2012 CRZ report, Uppunda, Deepika Shetty
- Central West Coast of India (derived from Quick scat data, 2008-2009
- Weatherspark.com- <https://weatherspark.com/y/107838/Average-Weather-in-Byndoor-India-Year-Round>
- http://wgbis.ces.iisc.ernet.in/energy/water/proceed/proceedings_text/section3/paper1/section3paper1.htm#REF
- <https://jlorexplore.com/explore/unexplored-areas/birding-around-udupi>
- Ravikumar, P., & Somashekar, R. K. (2013). A geochemical assessment of coastal groundwater quality in the Varahi river basin, Udupi District, Karnataka State, India. *Arabian Journal of Geosciences*, 6(6), 1855-1870.
- BIS (Bureau of Indian Standards) 10500, Indian standard drinking water specification, First revision, 2012, pp 1-8.
- Kotian, Akshay., Pavan Kumar U., Sachin Kumar S., Srikanth N. S., Deepika. B. V. (2018) Assessment of Ground Water Quality in Udupi District, Karnataka. *International Journal of Scientific Development and Research*, 3(5), 522-527.
- <http://cgwb.gov.in/Documents/WQ-standards.pdf>.
- Bartholomew, H. (1955). *Landuse in American Cities*. Cambridge: Harvard University Press.
- Bhat, G. (1969). *Antiquities of South Kanara*. Udupi: Prabhakar Press.
- Dickinson, R. (1948). The scope and Status of Urban Geography. *Land Economics*, XXIV, 221-38.

- Frey, H. (1999). *Designing the city towards a more sustainable urban form*. New York, London: E & FN Spon, an imprint of Routledge.
- Nevis, S. K. (2001). *An Assessment of Beach Erosion Hazards in St. Kitts and Nevis*.
- Ricker, M. (2020). *What are alluvial soils?* Retrieved from Soils Matter
- Shetty, D. (2012). *Comprehensive plan of coastal regulation zone in Udupi district - Part 1*.
- (n.d.). *The ground water yearbook of Karnataka*.
- . S., & Bhatta, R. (2012). *Small-scale Cage Culture of Asian Seabass in Kundapur Region* ,. 47–51.
- Sasikumar, G., Mohamed, K. S., & Asokan, P. K. (2010). *ORGANIC AQUAFARMING INITIATIVES IN KARNATAKA : A SUCCESS STORY*. 39(3), 2010.
- Shodhgangan introduction. (n.d.). Profile of the Study Area: Coastal. *Shodhganga*, 75–102. https://shodhganga.inflibnet.ac.in/bitstream/10603/10057/8/08_chapter3.pdf
- *Uppunda Village Population - Kundapura - Udupi, Karnataka*. (n.d.). Retrieved October 16, 2020, from <https://www.census2011.co.in/data/village/608663-uppunda-karnataka.html>
- <https://rcmysore-portal.kar.nic.in/temples/uppundadurgaparameshwari/Festivals.htm>
- CLUSTERING VISITORS TO A RELIGIOUS PLACE/Manipal University, gazetteer
- Operational for modalities Skill Training of Rural Youth (STRY) under Sub-Mission on Agricultural Extension(SMAE) National Mission on Agriculture Extension & Technology(NMAET).
- Karnataka Skill Development Policy: 2017, Kausalya Karnataka- Kushala Karnataka (2017-2030).
- District wise skill gap study for the State of Karnataka-2013.
- Pre-Feasibility Report of Institutional Structuring of Vocational Training in Karnataka by Infrastructure Development Department (IDD), Government of Karnataka.
- Skill development Initiatives and measures in India- A Study Report.2013
- Model Project on Shrimp Papad- Prepared by NABARD Consultancy Services Private Limited.
- Process of paddy parboiling and their effects on rice- A Review- Vikrant kumar, Jaivir singh, Neelash Chauhan, Suresh Chandra, Vivak, Kumar and MK Yadav.2018.
- A Feasibility Report on New Business Development of peanut processing at gogapura in Bhiladi. 2015.
- MSME Schemes- Government of India, Ministry of Micro, Small and Medium Enterprises. 2015.
- Present status, Future Prospect and Potential of Post-Harvest Processing of Coconut by Kumari Dipti Dhoba. 2015.
- District Census Handbook, Udupi, Directorate of Census Operations, Karnataka Ministry of Home Affairs.
- Udupi District Human Development Report 2008', Strengthening State Plans For Human Development(Ssphd) Project, Published By Planning, Programme Monitoring And Statistics Department, Government Of Karnataka
- 1 G.S. Dwarakish Et All, 'Coastal Vulnerability Assessment Of The Future Sea Level Rise In Udupi Coastal Zone Of Karnataka State, West Coast Of India', In Ocean & Coastal Management 52 (2009) 467–478
- 1Icmam-Pd,'A Report On Management Of Tidal Inlets Along West Coast', Ministry Of Earth Sciences, Government Of India, Local Implementing Agency Nitk, Surathkal, June 2007.
- ¹ Vinayaraj P Et All, 'Quantitative Estimation Of Coastal Changes Along Selected Locations Of Karnataka, India: A Gis And Remote Sensing Approach', International Journal Of Geosciences, 2011, 2, 385-393, Doi:10.4236/Ijg.2011.24041 Published Online November 2011 (<http://www.scirp.org/journal/Ijg>)
- 1 Kunte P.D., B.G.Wagle, 'Spit Evolution And Shore Drift Direction Along South Karnataka Coast', 1991, Pulished In Giornale Di Geologia, Ser. 3, Vol 53, No2, 1991, Pp. 71-80, Bologna
- 1 Jayappa, K.S.; Vijaya Kumar, G.T., And Subrahmanya, K.R., 2003, 'Influence Of Coastal Structures On The Beaches Of Southern Karnataka, India', In Journal Of Coastal Research, 19(2), 389-408. West Palm Beach (Florida), Issn 0749-0208.
- http://Drs.Nio.Org/Drs/Bitstream/2264/3280/2/Giornale_Geol_53_71.Pdf
- http://Moef.Nic.In/Downloads/Public-Information/Nwia_Karnataka_Atlas.Pdf
- 1 Sitharam T.G. Et All, 'A Study On Seismicity And Seismic Hazard For Karnataka State', J. Earth Syst. Sci. 121, No. 2, April 2012, Pp. 475–490
- 1'Udupi District Human Development Report 2008', Strengthening State Plans For Human Development(Ssphd) Project, Published By Planning, Programme Monitoring And Statistics Department, Government Of Karnataka



- 1 Gadgil Madhav Et Al, 'Karnataka State of Environment Report And Action Plan Biodiversity Sector', December 2004, Envis Technical Report No 16, Centre For Ecological Sciences, Iisc Bangalore.
- 1 Subash Chandran M.D., Rao G.R., Et Al, 'Green Walls for Karnataka Sea Coast', Honavar Forest Division- Oct2010), Centre for Ecological Sciences, Iisc, Bangalore, Submitted To Karnataka Forest Department, Honavar Division, Uttara Kannada.
- 1 'National Wetland Atlas-Karnataka by Ministry of Forest and Environment, Government Of India, August 2010, Prepared By Isro, Ahmedabad.
- 1 'Ground Water Information Booklet for Udupi District', June 2008, Published By Central Ground Water Board, Ministry Of Water Resource, Government Of India.
- 1 Annepu Ranjith Kharvel , Sustainable Solid Waste Management In India, January 2012, Waste To Energy Research And Technology Council, Columbia University
- 1 Sat Ejournal | Ejournal.Icrisat.Org August 2006 | Volume 2 | Issue 1, An Open Access Journal Published By Icrisa.
- 1 : The Nutrition And Feeding Of Farmed Fish And Shrimp.(Produced By: Fisheries And Aquaculture Department) Food And Agricultural Organisation. Govt. Of India
- 1 The Nutrition and Feeding of Farmed Fish and Shrimp. (Produced by: Fisheries and Aquaculture Department) Food and Agricultural Organisation. Govt. Of India
- 1 [Http://Www.Gogreensol.Com/Biodigester.Php](http://www.gogreensol.com/biodigester.php).
- 1 Centre for Environment and Development,' World Bank Assisted Integrated Coastal Zone Management Project Environmental and Social Assessment' November 2009, Ministry of Environment and Forest, Government of India
- 1 [Http://Www.Enviro-Form.Com/Riverbank.Htm](http://www.enviro-form.com/riverbank.htm)
- 1 Handbook On Design and Construction of Housing for Flood-Prone Rural Areas of Bangladesh Published by Asian Disaster Preparedness Center
- 1 litk-Bmtpc Earthquake Tips.
- Shankar H.N.Udaya, 'Landform Analysis Of Coastal And Hinterland A Part Of Dakshin Kannada Using Remote Sensing Techniques', Aug 1994 Unpublished Doctoral Thesis Submitted To Mangalore University

11. Annexure I On-site Observation Check List:

Socio-Economic Aspects:

1. Regional Level

- Climate
- Soils
- Water
 - Source and the courses of the water body
- Transportation & approaches
- Energy
- Economy
- Architectural character
- Landscape character
 - Conserved forest / agricultural / production land or precinct
 - Cultural/holy protected area
 - Regional topography (slope and landform)
- Cultural amenities- Temples, community festival spaces, etc.
- Recreational Amenities - parks
- Employment opportunities
- Healthcare facilities
- Major detraction
- Exceptional features

2. Community Level

- Travel – time distance (for necessary activities)
- Travel experience
- Community ambiance
- Schools
- Shopping
- Religious
- Cultural amenities
 - Cultural association to water bodies and precinct
 - Tree species with social or cultural values
- Public services
- Safety and security
- Medical facilities
- Governance
- Taxes and revenue
- Influence zone
- Major detraction
- Exceptional features (scale)
- Commercial trees or crops
- Communal spaces – katte or paars, waterfront sit outs, etc.
- Funeral spaces
- Markets

3. Property/Site Level

- Size and shape
- Approaches
- Entrances and exits
- Nodes
- On-site 'feel'
- Water (River / Stream / Lakes / Aquifers / Tanks)
 - Utilitarian / Religious
 - Natural / Artificial
- Permanent landscape features
 - Old & Mature Trees / Medicinal trees
 - Grazing / Pastures
- Need for clearing
- Ground form and gradients
- Soils
- Site drainage
- Immediate neighbors
- Adjacent structures
- Relationship to circulation patterns
- Sights
- Views to and from site
- Observation points
- Orientation to sun, wind, and rain
- Privacy
- Cultural/societal influence over Daily routine
- Signages
- Housing –Kacha, Pucca, Materials, size, typology.
- Assets – Movable, immovable, Livestock
- Saving pattern, spending capacity



- Occupations – Primary, Secondary, etc.
- Migrant & Immigrant

Infrastructural Aspects:

1. Transport and Communication Network

- Condition of road, potholes, etc. (if any), provision of the pedestrian walkway
- Road site vehicular parking and other related issues.
- Signage, traffic control, religious significance (if any)
- Existing Traffic conditions
- Road characteristics (Length, width)
- Services along the road, Paving materials, etc.
- Length, width, function (motorable or pedestrian), Construction material of bridges/ flyovers, etc.

2. Irrigation and Water Supply

- Condition of water sources like hand pumps, OHTs, etc.
- Municipal Supply lines- if present or not
- Wells (lined/un-lined)- in case of individual households
- Storage Tanks (portable or fixed)
- Condition of water canals, lakes, ponds, and any other water source.

3. Electricity and Fuel Supply

- Condition of electric poles/ sub- stations/ transformers.
- Present lighting conditions on streets (solar streetlights, if any)
- Issues related to Overhead Lines Telephone lines- safety features, etc.

4. Housing and Basic Amenities

- The present condition of the Building, plinth height, foundation, construction materials for building components.
- Other facilities and amenities in the vicinity and their present conditions (Present conditions like Construction type).
- Condition of abandoned areas and its present usage.
- Condition of open spaces and any issues related to it.

5. Waste Disposal, Drainage, and Sanitation

- Condition at Household level- Soak pits, Septic tanks
- Panchayat level- public sewerage system- present or not.
- Solid waste- collection system/ availability of garbage collection pits/ dustbins etc.
- Drain characteristics- conditions of Stormwater drains
- Condition of public sewerage system etc.

6. Food Supply and Nutrition Services

- Conditions like Daily Market or vegetable market, Grocery shop and its proximity to households/ communities, etc.
- Condition of stockyards/ godowns, its maintenance.

7. Health Delivery System

- Present condition, Construction type, No. of Beds, Patient numbers
- Need for improving infrastructure

8. Schooling and Education

- Present condition
- Construction type

9. Employment and Self-Employment

- Engagement in farm activities.
- Other private non- farm activities (Stores & Stationery, Electronic shops, Barber shop, Betel or pan shop, Meat, fish market or shop)

10. Farm sector Development

- Conditions of agricultural lands
- Any other related issues like irrigation methods, water supply, etc.

11. Industry and Trade

- Present Condition
- Challenges in Quantity of produce/ Supply and distribution of goods
- Construction type



12. Annexure II Survey Form

Survey Form - English

HOUSEHOLD SURVEY														
Name of Respondent:						Time Period of Residence:				Location:				
Religion:		Caste:		Ownership:		Rent:		BPL Card:		Ration Card:				
BASIC INFORMATION														
Member	Age	Sex	Marital Status	Qualification	Location of Education Facility	Occupation	Location of Job	Vehicle Owned					Place of Migration	Digital Literacy
								2W	3W	4W	Cycle	None		
Change in Occupation if any: _____ Since When and Reason: _____														
MOBILE USAGE/NETWORK														
Member	Connectivity		Use of Internet		WiFi/Broadband		Purpose of Use							
	Good	Poor	Yes	No	Yes	No	Family Connect	Work	Study	Online Shopping	Emergency Use			
OCCUPATION														
IF AGRICULTURE				IF SKILLED/UNSKILLED LABOUR					IF BUSINESS					
No. of members involved:				1 2 3					1 2					
Area		Soil Type		Type					Type					
Crop Type				Location					Location					
Frequency				Mode of Travel					Mode of Travel					
Source of Irrigation				Travel Distance					Travel Distance					
if yes, scheme/private				Marginal/Full Year					Marginal/Full Year					
Seeds Availability (From where)				Wages					Annual Income					
is there any change in cropping pattern				IF INDUSTRIAL LABOUR										
Store Location				Type					Travel Distance					
Where do you sell				Location					Shifts					
Produce p.a.				Mode of Travel					Salary					
IF SERVICE JOB														
Type				Travel Distance										
Location				Shifts										
Mode of Travel				Salary										
LAND HOLDING														
Khasra No.				Area:				Time Period of Land Holdings:						
Cultivable:				Fallow:										
Additional Land Holding:				Area:				Purpose:						
HOUSING (Built up Detail)														
Type of Structure		Kachcha		Pucca		Semi Pucca								
Material (Roof)		Grass/thatch/bamboo		Mud		Unburnt Bricks		Stone with Mortar						
Material (Wall)		Grass/thatch/bamboo		Mud		Unburnt Bricks		Stone with Mortar						
Building Height		G		G+1		G+2		G+3						
Scheme (Y/N)														
Age of structure		Less than 10 Years		10-20 Years		20-50 Years		More than 50 Years						
Condition		Good		Livable		Dilapidated								
SERVICES														
Services	Availability	Frequency	Travel Distance	Facilities	Seasonal Interruptions									
					Summer	Rainy								
Water Supply & Storage (Image to be attached)				Well / Hand pump / Bore well / Private Tap / Public Tap										
Solid waste collection (Image to be attached)				Open Dumping / Compost / Collection Cart										
Electricity				House Hold / Irrigation										
Transportation				Bus / Tempo / Tractor / Bullock Cart / 2 wheeler / 4 wheeler / Cycle										
Telephone														
Cooking Fuel (Image to be attached)				LPG/ Kerosene/Fire wood/Biogas/Dung Cake										
Best Practises (Image to be attached)				Rain water Harvesting/Composting/Kitchen Garden/ Solar Appliances										

TOILETS									
Availability (Y/N)	If Yes, Under Use (Y/N)	Public	Private	Community	Open defecation	Under Scheme/Own Construction	If under scheme, Amount received:	Availability of water Connection (Y/N)	Image to be attached

MONTHLY EXPENDITURE						
Criteria	Food	Health	Education/Training	Transportation	Rent	Leisure
Ranking						

Lump-sum Monthly Expenditure: _____ If paying Interest then how much: _____ Time period of Interest: _____

HEALTH													
Member	Health Card/ Insurance	Habits				Location of Primary Health Care	Location of Critical Care	Mode of travel	Travel Distance	No. of visit to Hospital in a month	Fees paid for 1 time visit	Health Issues for past 2 years	Cause of Death If any
		Alcohol	Smoking	Tobacco	Others								

Vaccination if any: Yes/No
Awareness about the various Government health schemes: Yes/No

ASSETS									
Livestock		Number	Problem/Disease		Commercial (Y/N)		Other Assets		Yes/No
Cow/Buffalo							Television		
Ox							Smartphone		
Goats							Refrigerator		
Chickens							Solar Appliances		
Horses							Stove Type		
Donkeys							Computer/Laptop		
Others									

SUGGESTIONS FOR IMPROVEMENT OF VILLAGE INFRASTRUCTURE				
Social Facilities	Education Facilities	Health/Care Facilities	Business Facilities	Employment Facilities

Survey Form - Kannada

ಹೌಸ್‌ಹೋಲ್ಡ್ ಸರ್ವೆ														
ಪ್ರತಿವಾದಿಯ ಹೆಸರು:						ನಿವಾಸದ ವಿವರ:				ಸ್ಥಳ:				
ಧರ್ಮ:						ಜಾತಿ				ಮಾಲೀಕತ್ವ:				
ಮೂಲ ಮಾಹಿತಿ						ಬಿವಿಎಲ್ ಕಾರ್ಡ್:				ಪರಿಶರಣೆ:				
ಸದಸ್ಯ	ವಯಸ್ಸು	ಲಿಂಗ	ವೈವಾಹಿಕ ಸ್ಥಿತಿ	ಶೈಕ್ಷಣಿಕ ಅರ್ಹತೆ	ಶಿಕ್ಷಣ ಸೌಲಭ್ಯದ ಸ್ಥಳ	ಉದ್ಯೋಗ	ಉದ್ಯೋಗದ ಸ್ಥಳ	ವಾಹನ ಮಾಲೀಕತ್ವ					ವಲಸೆಯ ಸ್ಥಳ	ಡಿಜಿಟಲ್ ಸಾಕ್ಷರತೆ
								2W	3W	4W	ಸ್ಕೆಲರ್	ಇಲ್ಲ		
ಉದ್ಯೋಗದಲ್ಲಿ ಬದಲಾವಣೆ: _____ ಯಾವಾಗ ಮತ್ತು ಕಾರಣ: _____														

ಮೊಬೈಲ್ ಬಳಕೆ / ನೆಟ್‌ವರ್ಕ್												
ಸದಸ್ಯ	ಸಂಪರ್ಕ		ಇಂಟರ್ನೆಟ್ ಬಳಕೆ		WiFi/ಬ್ರೂಬ್ಯಾಂಡ್		ಬಳಕೆಯ ಉದ್ದೇಶ					
	ಒಳ್ಳೆಯದು	ಕಳಪೆ	ಹೌದು	ಇಲ್ಲ	ಹೌದು	ಇಲ್ಲ	ಕುಟುಂಬ ಸಂಪರ್ಕ	ಕೆಲಸ	ಅಧ್ಯಯನ	ಇನ್ಟರ್ನೆಟ್ ಶಾಪಿಂಗ್	ತುರ್ತು ಬಳಕೆ	

ಜೀವನೋಪಾಯ												
ಕೃಷಿ / ತೋಟಗಾರಿಕೆ				ಕೌಶಲ್ಯ / ಕೌಶಲ್ಯರಹಿತ ಲೇಬರ್ / ಮೀನುಗಾರಿಕೆ / ಕೈಗಾರಿಕೆ			ವ್ಯಾಪಾರವಾಗಿದ್ದರೆ					
ಒಳಗೊಂಡಿರುವ ಸದಸ್ಯರ ಸಂಖ್ಯೆ:				1			2			3		
ವಿಸ್ತೀರ್ಣ	ಮಣ್ಣಿನ ಪ್ರಕಾರ			ವಿಧ			ವಿಧ			1	2	
ಬೆಳೆ ಪ್ರಕಾರ				ಸ್ಥಳ			ಸ್ಥಳ					
ಆವರ್ತನ				ಪ್ರಯಾಣದ ವಿಧಾನಗಳು			ಪ್ರಯಾಣದ ವಿಧಾನಗಳು					
ನೀರಾವರಿ ಮೂಲ				ಪ್ರಯಾಣದ ದೂರ			ಪ್ರಯಾಣದ ದೂರ					
ಹೌದು, ಸ್ಕೀಮ್ / ಖಾಸಗಿ				ಕನಿಷ್ಠ / ಪೂರ್ಣ ವರ್ಷ			ಕನಿಷ್ಠ / ಪೂರ್ಣ ವರ್ಷ					
ಬೀಜಗಳ ಲಭ್ಯತೆ(ಎಲ್ಲಿಂದ)				ವೇತನ			ವಾರ್ಷಿಕ ಆದಾಯ					
ಬೆಳೆ ವಿಧಾನದಲ್ಲಿ ಯಾವುದೇ				ಗುಣಮಟ್ಟ ಮತ್ತು ಬೆಂಬಲ ಸ್ಥಿತಿ ವಿವರಣೆ ಮತ್ತು ಸಮಸ್ಯೆಗಳು ಯಾವುದಾದರೂ ಇದ್ದರೆ								
ಅಂಗಡಿ ಸ್ಥಳ				ಉದ್ಯೋಗ ಸೌಲಭ್ಯ			ಆರ್ಥಿಕ ಭದ್ರತೆ / ಭವಿಷ್ಯ ನಿಧಿ					
ಮಾರಾಟ ಮಾಡುವ ಸ್ಥಳ				ನೈರ್ಮಲ್ಯ ಸೌಲಭ್ಯ			ಕೆಲಸದ ಸಮಯ/ವರ್ಗಾವಣೆಗಳು					
Produce p.a.				ವೈದ್ಯಕೀಯ ಬೆಂಬಲ			ಯಾವುದೇ ಇತರ ಟೀಕೆಗಳು					
ಸೇವಾ ಕಲಿಸುವಿದ್ದರೆ												



ಗ್ರಾಮ ಇನ್ಫ್ರಾಸ್ಟ್ರಕ್ಚರ್ ಸುಧಾರಣೆಗೆ ಸಲಹೆಗಳು				
ಸಾಮಾಜಿಕ ಸೌಲಭ್ಯಗಳು	ಶಿಕ್ಷಣ ಸೌಲಭ್ಯಗಳು	ಹೆಲ್ತ್ ಕೇರ್ ಸೌಲಭ್ಯಗಳು	ವ್ಯಾಪಾರ ಸೌಲಭ್ಯಗಳು	ಉದ್ಯೋಗ ಸೌಲಭ್ಯಗಳು

13. Annexure III - Natural Setting

Table 13-1 Flora and Fauna in Udupi, Karnataka

Flora			
Sl. No.	Scientific Name of Species	Family	Common name
1	<i>Alstonia Scholaris</i>	Apocynaceae	Haale mara
2	<i>Aporosa lindleyana</i>	Euphorbiaceae	Saroli mara
3	<i>Artocarpus hirsutus</i>	Moraceae	Hebbalasu
4	<i>Bambusa bamboa</i>	Poaceae	Bidiru
5	<i>Bryophyllum pinnatum</i>	Rosaceae	Kaadubasale
6	<i>Calophyllum inophyllum</i>	Clusiaceae	Honne mara
7	<i>Calycopteris floribunda</i>	Combretaceae	Enjir soppu
8	<i>Canthium dicoccum</i>	Combretaceae	Ammehannu
9	<i>Careya arborea</i>	Melastomataceae	Daddaala
10	<i>Carissa congesta</i>	Apocynaceae	Karande
11	<i>Cassia tora</i>	Fabaceae	Thagathe
12	<i>Caryota urens</i>	Araceae	Baini mara
13	<i>Cinnamomum verum</i>	Lauraceae	Daalcheeni
14	<i>Clerodendrum viscosum</i>	Verbenaceae	Thaggi gida
15	<i>Cuminum cyminum L.</i>	Apiaceae	Jeerige, Jeerdari
16	<i>Ervatamia heyneana (Wall.) Cooke</i>	Apocynaceae	Maddarasa, Kokke kayi
17	<i>Rauvolfia serpentina (L.) Benth.</i>	Apocynaceae	Sarpagandha Patalagaruda
18	<i>Tabernaemontana divaricata (L.) R. Br.</i>	Apocynaceae	Nandibattalu, Nanjatte
19	<i>Caryota urens L.</i>	Arecaceae	Baine, Indu
20	<i>Aristolochia indica L.</i>	Aristolochiaceae	Ishwara беру
21	<i>Calotropis gigantea (L.) R. Br.</i>	Asclepiadaceae	Akka, Akkamale
22	<i>Hemidesmus indicus (L.) Schult.</i>	Asclepiadaceae	Namada беру, Nannari, ookurma
23	<i>Elephantopus scaber L.</i>	Asteraceae	Nela mucchir
24	<i>Barringtonia racemosa (L.) Spreng.</i>	Barringtoniaceae	Samudra pala
25	<i>Caesalpinia bonduc (L.) Roxb.</i>	Caesalpiniaceae	Gajjuga, Kaat kalenji kayi
26	<i>Tamarindus indica L.</i>	Caesalpiniaceae	Hunase, Puli
27	<i>Celastrus paniculatus Willd.</i>	Celastraceae	Gangamma balli
28	<i>Cuminum cyminum L.</i>	Apiaceae	Jeerige, Jeerdari
29	<i>Colocasia esculenta</i>	Araceae	Kesu
30	<i>Costus speciosus</i>	Zingiberaceae	Narikabbu
31	<i>Cyclea peltata</i>	Menispermaceae	Haade balli
32	<i>Cynodon dactylon</i>	Poaceae	Garike
33	<i>Elephantopus scaber</i>	Asteraceae	Nelamuchhilu
34	<i>Ficus benghalensis</i>	Moraceae	Aalada mara
35	<i>Ficus benghalensis</i>	Moraceae	Atti mara
36	<i>Flacourtia indica</i>	Flacourtiaceae	Jeide
37	<i>Garcinia indica</i>	Clusiaceae	Punerpuli
38	<i>Garcinia morella</i>	Guttiferae	Jaarige
39	<i>Garcinia gummigutta</i>	Guttiferae	Vaate Huli



40	<i>Gloriosa superba</i>	Liliaceae	Gowri hoo
41	<i>Hemidesmus indicus</i>	Periplocaceae	Naanadaberu
42	<i>Holarrhena pubescens</i>	Apocynaceae	Kodasiga
43	<i>Holigarna arnottiana</i>	Anacardiaceae	Chera
44	<i>Hopea parviflora</i>	Dipterocarpaceae	Bogi
45	<i>Hopea ponga</i>	Dipterocarpaceae	Karimara
46	<i>Jasminum malabaricum</i>	Oleaceae	Kaddu mallige
47	<i>Madhuca nerifolia</i>	Sapotaceae	Uppaligana mara
48	<i>Mangnifera indica</i>	Anacardiaceae	Maavu
49	<i>Memecylon amplexicaule</i>	Melastomataceae	Ollekodi
50	<i>Melastoma malabathricum</i>	Melastomataceae	Nekkarika
51	<i>Musa paradisiaca</i>	Musaceae	Banana
52	<i>Memecylon amplexicaule</i>	Melastomataceae	Ollekodi
53	<i>Myristica frgrans</i>	Myristaceae	Jayikaayi
54	<i>Myristica malabarica</i>	Myristaceae	Ramapatre
55	<i>Pandanus fascicularis</i>	Pandanaceae	Kedage
56	<i>Phyllanthus emblica</i>	Euphorbiaceae	Nellii mara
57	<i>Pongamia pinnata</i>	Fabaceae	Honge mara
58	<i>Smilax zeylanica</i>	Pontederiaceae	Chenne booru
59	<i>Strychnos nuxvomica</i>	Gentianaceae	Kaasarkana mara
60	<i>Syzygium caryophyllatum</i>	Myrtaceae	Kuntangila
61	<i>Tabernaemontana heyneana</i>	Apocyanaceae	Maddarasa
62	<i>Terminalia paniculata</i>	Myrtaceae	Mathi
63	<i>Vateria indica</i>	Dipterocarpaceae	Dhoopa
64	<i>Vitex negundo</i>	Lamiaceae	Lakki gida
65	<i>Ziziphus oenoplia</i>	Rhamnaceae	Choori mullu
66	<i>Acanthus ilicifolius</i>	Acanthaceae	Mangrove plant
67	<i>Acrostichum aureum</i>	Pteridaceae	Mangrove plant
68	<i>Aegiceras corniculatum</i>	Myrsinaceae	Mangrove plant
69	<i>Avicennia alba</i>	Avicenniaceae	Mangrove plant
70	<i>Avicennia officinalis</i>	Avicenniaceae	Mangrove plant
71	<i>Bruguiera gymnorhiza</i>	Rhizophoraceae	Mangrove plant
72	<i>Excoecaria agallocha</i>	Euphorbiaceae	Mangrove plant
73	<i>Kandelia candel</i>	Rhizophoraceae	Mangrove plant
Fauna			
1	<i>Puntius filamentosus</i>	Cyprinidae	Filament barb/Threadfin silver biddy
2	<i>Puntius chola</i>	Cyprinidae	Swamp barb/chola barb
3	<i>Puntius dorsalis</i>	Cyprinidae	Long shouted barb
4	<i>Cirrhinus mrigala</i>	Cyprinidae	Red tailed carp
5	<i>Tor khudree</i>	Cyprinidae	Yellow masheer
6	<i>Barilies bendelisis</i>	Cyprinidae	Hamitons barila
7	<i>Amblypharyngodon mola</i>	Cyprinidae	Mola carpet
8	<i>Garra mullya</i>	Cyprinidae	Mullya garra
9	<i>Labeo chrysophekadion</i>	Cyprinidae	Black shark
10	<i>Mystus monatanus</i>	Bagridae	Striped dwarf catfish

11	<i>Horabagrus nigracollaris</i>	Bagridae	Black collared catfish
12	<i>Ompok malabaricus</i>	Siluridae	Catfish
13	<i>Clarias dossumeri</i>	Claridae	Walking catfish
14	<i>Xenentodon cancila</i>	Belonidae	Freshwater garfish
15	<i>Ambassis commersoni</i>	Ambassidae	Commerson's glassy perchlet
16	<i>Lobotes surinamensis</i>	Lobotidae	Triple tail
17	<i>Pomadasys olivaceum</i>	Haemulidae	Grunt
18	<i>Etroplus suratensis</i>	Cichlidae	Pearl-spot
19	<i>Channa punctatus</i>	Channidae	Spotted snake wad
20	<i>Mastacembelus armatus</i>	Mastacembelidae	Spiny eel
21	<i>Anoplolepis gracilipes</i>	Formicinae	Yellow crazy ant
22	<i>Camponotus compressus</i>	Formicinae	Godzilla ant
23	<i>Camponotus oblongus</i>	Formicinae	C. oblongus
24	<i>Oecophylla smaragdina</i>	Formicinae	Red ant
25	<i>Cardiocondyla nuda</i>	Myrmicinae	C. nuda
26	<i>Crematogaster subnuda</i>	Myrmicinae	C. subnuda
27	<i>Meranoplus bicolor</i>	Myrmicinae	M. bicolor
28	<i>Monomorium pharaonis</i>	Myrmicinae	Pharaoh ant
29	<i>Anochetus ghilianii</i>	Ponerinae	A. ghilianii
30	<i>Ponera rugosa</i>	Ponerinae	P. rugosa
31	<i>Tapinoma melanocephalum</i>	Dolichoderinae	Ghost ant
32	<i>Tetraponera nigra</i>	Pseudomyrmecinae	T. nigra
33	<i>Panthera tigris tigris</i>	Felidae	Bengal tiger
34	<i>Panthera pardus</i>	Felidae	Common leopard
35	<i>Troides minos</i>	Papilionidae	Southern birdwing
36	<i>Papilio paris</i>	Papilionidae	Paris peacock
37	<i>Papilio buddha</i>	Papilionidae	Malabar banded peacock
38	<i>Euploea core</i>	Nymphalidae	Common Indian crow
39	<i>Strix huhula</i>	Strigidae	Black-banded owl
40	<i>Felis chaus</i>	Felidae	Jungle cat
41	<i>Sus scrofa cristatus</i>	Suidae	Indian boar
42	<i>Buceros bicornis</i>	Bucerotidae	Great hornbill
43	<i>Harpactes fasciatus</i>	Trogonidae	Malabar trogon
44	<i>Tor tambroides</i>	Cyprinidae	Mahseer
45	<i>Moschiola indica</i>	Tragulidae	Indian spotted chevrotain
46	<i>Lepus nigracollis</i>	Leporidae	Indian hare
47	<i>Petaurista philippensis</i>	Sciuridae	Indian giant flying squirrel
48	<i>Ophiophagus hannah</i>	Elapidae	King cobra
49	<i>Canis aureus</i>	Canidae	Golden jackal
50	<i>Rusa unicolor</i>	Cervidae	Sambar deer

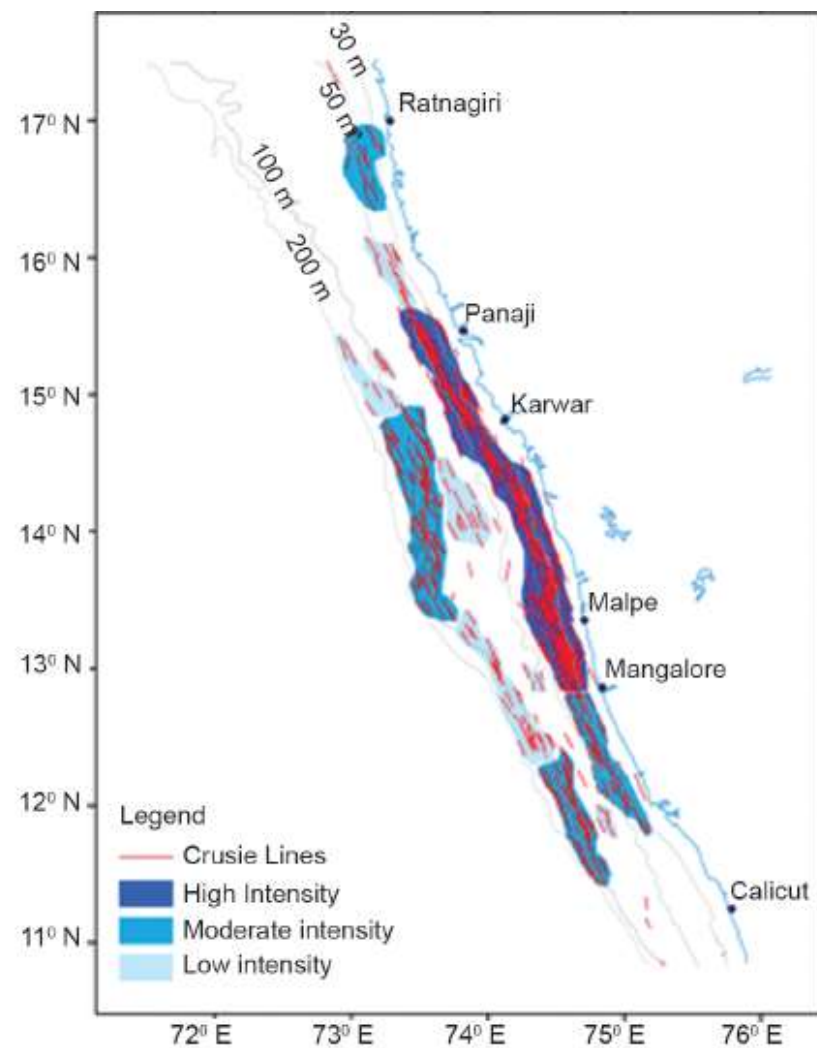


Figure 13-1 Extent of fishing ground and intensity of fishing at different fishing ground

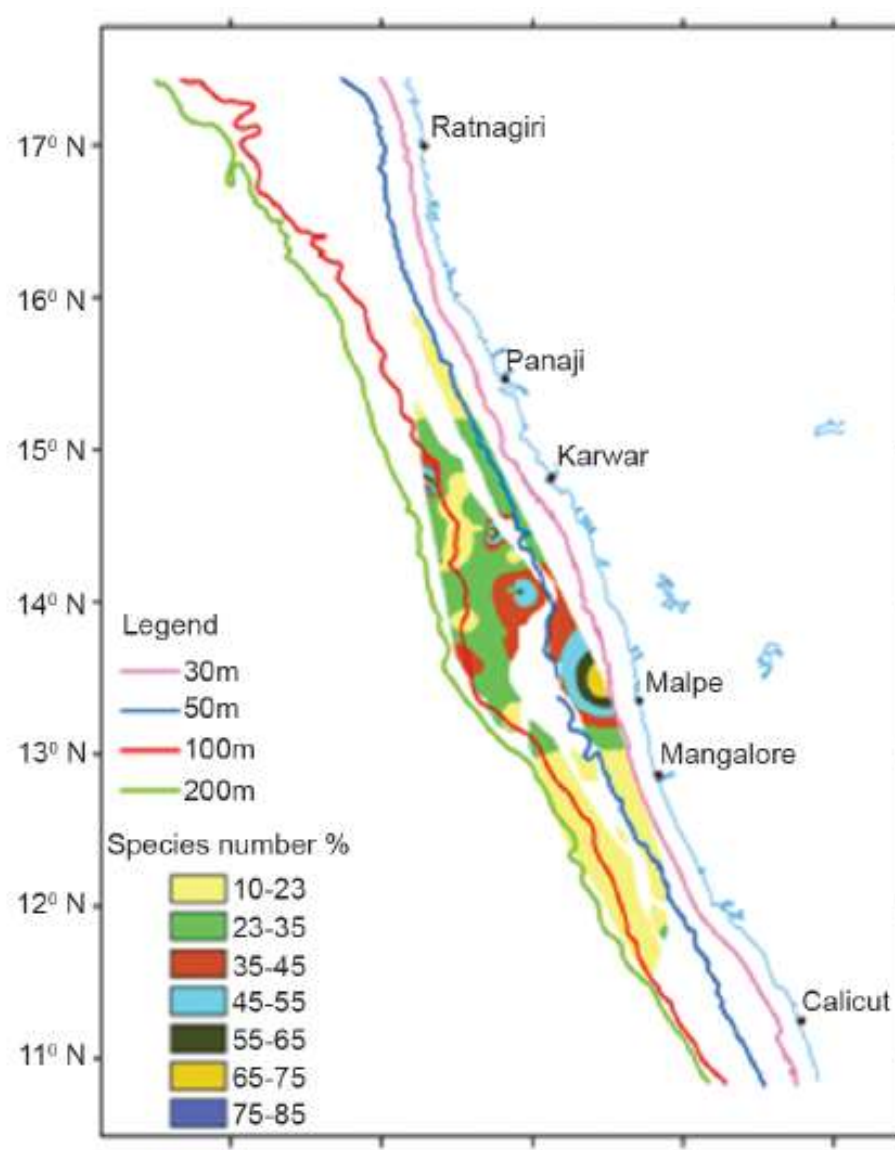


Figure 13-2 Distribution of reef related species

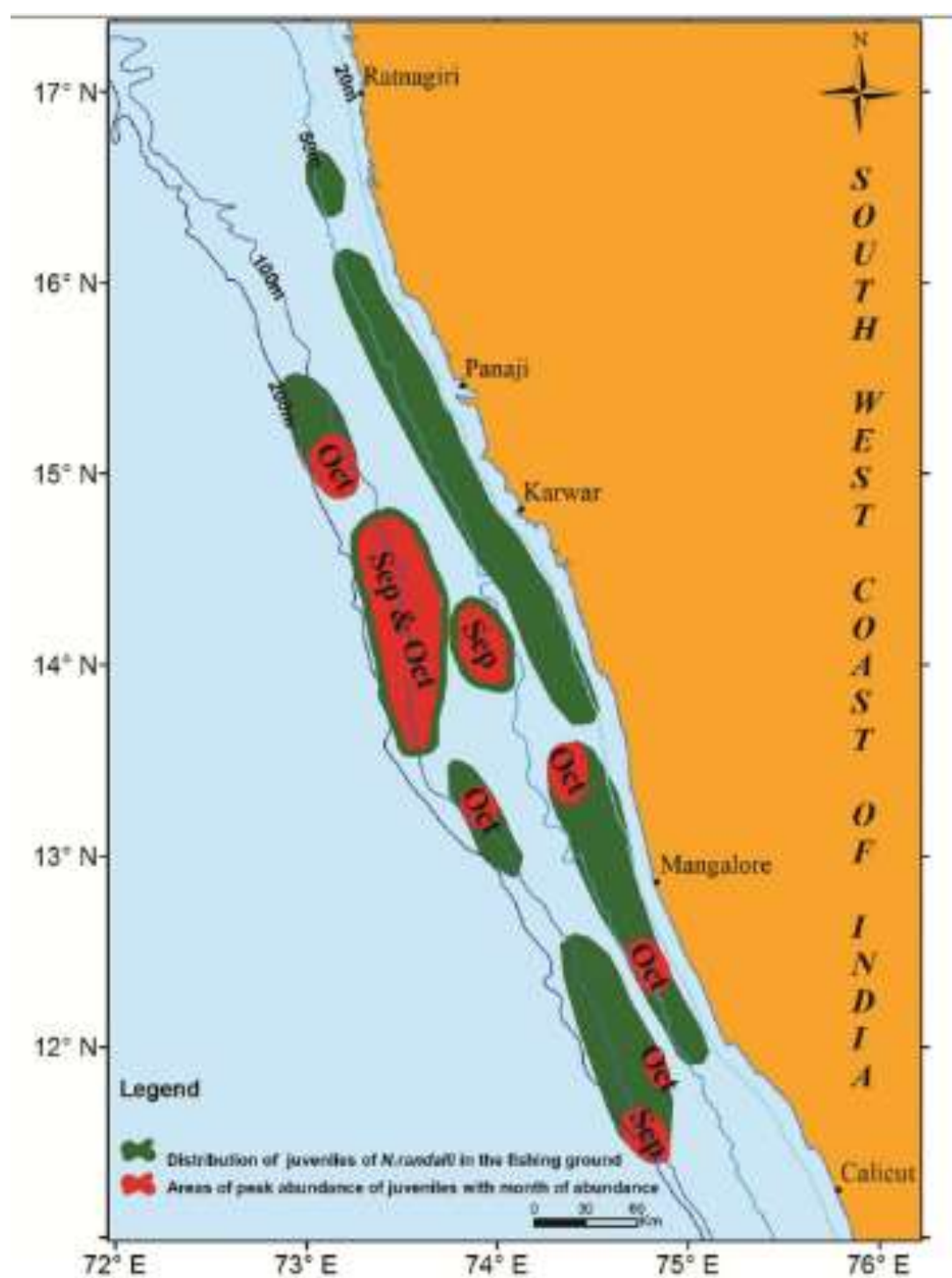


Figure 13-3 Critical ecosystem identified with respect to juvenile fishery of threadfin bream, one of the major species along the south-west coast of India



14. Annexure IV - Ground Water Table – Udupi District

DISTRICT AT A GLANCE-UDUPI DISTRICT			
SL NO	ITEM	STATISTICS	
1	GENERAL INFORMATION		
	i) Geographical area	3575 sq. km.	
	ii) Number of taluks	3 taluks	
	iii) Number of panchayats/villages	146/267	
	iv) Average annual Rainfall (mm)	4136.3	
2	GEOMORPHOLOGY		
	Major physiographic units	03	
	Major drainages	West flowing	
3	LAND USE (Ha)		
	a) Forest area	100102	
	b) Net area sown	82084	
	c) Cultivable area	85766	
4	MAJOR SOIL TYPES	i) Sandy soil ii) Yellow loamy soil iii) Red lateritic soil	
5	AREA UNDER MAJOR CROPS (Food crops As on 2005)	69974 Ha	
6	IRRIGATION BY DIFFERENT SOURCES (AREA and NO. of STRUCTURES)	Area (Ha)	No of structures
	Dug wells	15859	28612
	Tube wells/Borewells	445	382
	Tanks/Ponds	1848	300
	Canals/ Lift irrigation	5221	1984 lift irrigation schemes.
	Other sources/ Surface flow	8856	1599 other sources.
	Net irrigated area	22254 Ha	
	Gross irrigated area	-	
7	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (AS ON 31.3.2007)		
	No. of Dug wells	24	
	No. of Piezometers	04	
8	PREDOMINANT GEOLOGICAL FORMATIONS	Granitic gneisses, PGC with migmatites, Laterite capping, Coastal alluvium, fluvialite deposits and basic and acidic intrusives.	

Figure 14-1 Statistical Data for Ground Water in Udupi District, Source: Central Ground Water Board-2008

DISTRICT AT A GLANCE-UDUPI DISTRICT			
SL NO	ITEM	STATISTICS	
1	GENERAL INFORMATION		
	i) Geographical area	3575 sq. km.	
	ii) Number of taluks	3 taluks	
	iii) Number of panchayats/villages	146/267	
	iv) Population	1177908	
	iv) Average annual Rainfall (mm)	4136.3	
2	GEOMORPHOLOGY		
	Major physiographic units	03	
	Major drainages	West flowing	
3	LAND USE (Ha)		
	a) Forest area	100102	
	b) Net area sown	82084	
	c) Cultivable area	85766	
4	MAJOR SOIL TYPES	i) Sandy soil ii) Yellow loamy soil iii) Red lateritic soil	
5	AREA UNDER MAJOR CROPS (Food crops As on 2005)	69974 Ha	
6	IRRIGATION BY DIFFERENT SOURCES (AREA and NO. of STRUCTURES)	Area (Ha)	No of structures
	Dug wells	22184	27727
	Tube wells/Borewells	2149	2077
	Tanks/Ponds	4313	190
	Canals/ Lift irrigation	3724	2411 lift irrigation schemes.
	Other sources/ Surface flow	4060	585 other sources.
	Net irrigated area	27630 Ha	
	Gross irrigated area	-	
7	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (AS ON 31.3.2007)		
	No. of Dug wells	24	
	No. of Piezometers	04	
8	PREDOMINANT GEOLOGICAL FORMATIONS	Granitic gneisses, PGC with migmatites, Laterite capping, Coastal alluvium, fluvialite deposits and basic and acidic intrusives.	

Figure 14-2 Statistical Data for Ground Water in Udupi District, Source: Central Ground Water Board-2012

15. Annexure V - Wetland – Udupi District

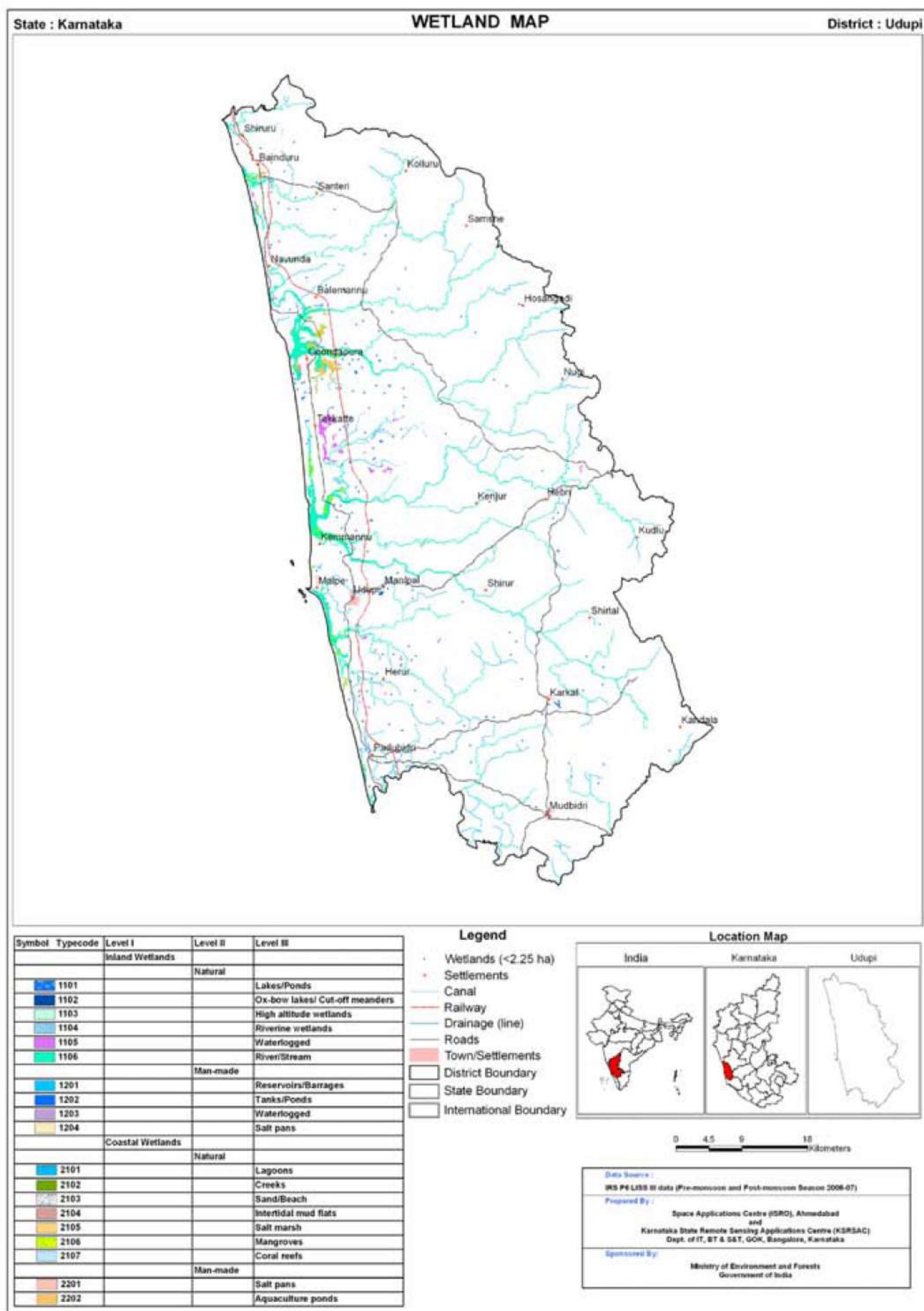


Figure 15-1 Map of wetland in Udupi District as per National Wetland Atlas by ISRO, Aug 2010



WETLAND MAP



Figure 15-2 Map of wetland in Udupi District as per National Wetland Atlas by ISRO, Aug 2010

16. Annexure VI – Road Infrastructure – Planning and Policies

1. Pradhan Mantri Gram Sadak Yojana (PMGSY)

• PMGSY-II_August, 2013

1. Need for consolidation of Rural Roads Network: Under PMGSY-I, out of the targets fixed under new connectivity as well as up-gradation over 70% of the projects have been sanctioned and a large proportion has been completed. However, the roads, both taken under the PMGSY - I as well as other schemes for rural roads have not received the desired attention on the maintenance front for several reasons, including low contracting capacity, poor maintenance practices, and inadequate feeling of ownership of the newly created roads at State level, etc. This has led to the erosion of assets created under various programs and the sustainability of assets created has not been ensured.
2. **PMGSY-II** envisages the consolidation of the existing Rural Road Network to improve its overall efficiency as a provider of transportation services for people, goods, and services. It aims to cover the up-gradation of existing selected rural roads based on their economic potential and their role in facilitating the growth of rural market centers and rural hubs. Development of growth centers and rural hubs are critical to the overall strategy of facilitating poverty alleviation through the creation of rural infrastructure. Growth centers/rural hubs would provide markets, banking, and other service facilities enabling the creation of self-employment and livelihood opportunities on an ongoing basis.

• PMGSY-January, 2015

1. The primary objective is to provide connectivity, by the way of an All-weather Road with all necessary culverts and cross drainage structures, which is operable throughout the year to eligible unconnected habitations as mentioned above.
2. The PMGSY will permit the upgradation of the existing roads in those districts where all the eligible habitations of the designated population size have been provided with all-weather road connectivity.

• PMGSY-III October, 2019

1. The PMGSY-III envisages consolidation of the existing Rural Road Network by upgradation of existing Through Routes and Major Rural Links that connect habitations to

1. Gramin Agricultural Markets (GrAMs)
2. Higher Secondary Schools
3. Hospitals

PMGSY-III will include such linkages.

2. The government is keen to facilitate easy and faster movement to and from the food processing centers, Mandi (Agricultural markets) and other farmer related enterprises. This is expected to transport both agricultural inputs as well as outputs. This not only helps the farm production, but also yields many direct and indirect benefits such as minimizing the spoilage of perishable goods like fresh fruits and vegetables and ensures adequate remunerative prices for them. Such a facility ultimately leads to increased agrarian economy and helps the development of the region, creating multiple opportunities in wage and self-employment.
3. Affordable and easy access to high schools and higher secondary schools is the need of the hour in the present technological improvements in all sectors. Education leads to multiple opportunities. Improved access to education centers helps in better school attendance and higher level of education.
4. Providing affordable and easily accessible health facilities is prime focus of the government for which road connectivity plays an important role. All weather roads have shown a very positive correlation to improve in health indicators.
5. The program will focus on upgradation of existing Through Routes and Major Rural Links based on priority giving importance to critical facilities like the rural markets and education & health facilities. However, new construction may be allowed only as a part of upgradation project to connect Gramin Agricultural Markets(GrAMs)/warehouses, Government hospitals and Educational Institutions, in case they are not connected already with a metalled road or require strengthening and widening of existing roads.

Key Features (<https://www.pmgys.nic.in/>, n.d.):

- **Preparation of rural Roads Plan and Core Network:** All roads under PMGSY are to be prioritized out of the Core Network keeping in view the priorities as per the Guidelines in respect of population size and giving preference to New Connectivity.
- **Roads specifications:** Roads are to be built as per the specifications given in Rural Roads Manual published by the Indian Roads Congress (IRC: SP20:2002). It may be noted that the Rural Roads Manual allows for a carriage way of



3.0m where traffic intensity is less than 100 motorised vehicles per day and where the traffic is not likely to increase due to situation, like, dead end, low habitation and difficult terrain condition. To ensure economy in respect of link roads, the carriageway width may be restricted to 3.0m in all such cases with corresponding reduction in roadway width etc. as per the Rural Roads Manual of GOI.

- **District level Programmes:** On this basis of the Core Network is prepared it is possible to estimate the length of roads required for New Connectivity as well as Upgradation for every District. The State's Allocation will, henceforth, be distributed among the Districts giving 80% based on road length required for providing connectivity to Unconnected Habitations. The District-wise allocation of funds would also be communicated to the Ministry / NRRDA every year by the State Government.
- **Scrutiny, Approval and Clearance:** The proposals prepared by the District Panchayats are to be approved by the State level Standing Committee. Thereafter, detailed Project Reports will be prepared for those roads and scrutinized by the State Technical Agencies (STAs) nominated by the NRRDA. The STAs have been selected from among the Indian Institutes of Technology, Regional Engineering Colleges and Government Engineering Colleges of repute. Proposals are to be sent to NRRDA for clearance based on the scrutiny completed by STAs.
- **Project clearance and Release of funds:** Projects will be cleared by the Empowered Committee of the Ministry of Rural Development and 25% of the estimated cost will be released at the time of clearance. Subsequent releases for all road works will be subject to utilization of 60% of earlier released funds as well as completion of 80% of the approved road works upto (but not including) the year previous to the current year and other standard conditions.
- **Fund management in State:** Each State would identify/create a State level Autonomous Agency to maintain and operate Bank account to receive project funds. The District Programme Implementation Units (DPIUs) will operate this account.
- **Execution:** No new Agency/Consultant will be created for execution of the scheme.
- **Tendering:** The works will be tendered as per Standard Bidding Document. Being circulated to the State Governments by NRRDA. Projects will be completed within 9-10 months except in case of Hilly States where the duration of the project will be for 18 months. Cost escalation, if any, due to changes in design or time-overruns or tender premium will be borne by the State Governments.
- **Monitoring and Quality:** Ensuring the quality of the road works shall primarily be the responsibility of the State Government/Union Territory Administrations, who are implementing the programme.
- In addition, District Vigilance and Monitoring Committee set up by the Ministry of Rural Development will also monitor the progress under the Scheme.
- **Computerization:** An Internet based software has been developed by C-DAC, Pune and installed along with hardware in all States and Districts. Training has also been provided to staff. It is expected that data regarding proposals and projects as well as detailed information regarding execution of new road works will be regularly entered into database. Regular updating of the software (called OMMS) is an essential requirement for continued funding of projects under PMGSY and failure to do so will affect releases.
- **Maintenance:** Roads under PMGSY are required to be maintained by the State Governments. State Governments have to communicate a satisfactory mechanism for the maintenance of rural roads under PMGSY in order to be able to receive Programme assistance. The Scheme envisages Performance Guarantee for five years by the Contractor. Thereafter, the road may be transferred to Panchayati Raj Institutions for maintenance.

Guidelines to be followed for a PMGSY Road (<https://www.pmgsy.nic.in/>, n.d.):

1. **Logo of Pradhan Mantri Gram Sadak Yojana :**

A logo is to be installed with the below mentioned specifications

Colour Specifications:

- Orange: Magenta 60%, Yellow 100%, Steel Grey: Black 40%
- Luminous paints are to be used
- Bar, Road and Lettering: Black 100%

Size:

- Diamond : 600mm x 600mm Plate 900mm x 250mm
- If road length is < 2 km one at finishing end of the road
- If road length is > 2 km one at every 2 km including the board at finishing point of the road



Figure 16-1 The Standard Dimensions of the logo, (Source: Sanjany Kataria,2019)

2. Informatory Sign Board

There is a requirement of Installing 3 different Information Boards as shown below:

Board 1

- Size of board will be 1500mm x 900mm.
- To be fixed at starting point of road.
- One board for one road upto 5 km.
- If road length is more, one additional board at finishing point of road. Bottom border in black colour will be used for writing slogan to be provided by the Ministry of Rural development.

From	To
Length :	Cost : Rs Lakh
Date of Commencement :	Date of Completion :
Period of Guarantee by Contractor 5 Years	
Name & Address of Contractor :	
Name & Address of Officer Incharge :	
Project Funded by Ministry of Rural Development, Govt. of India	
Work Executed by :	Govt. of :

Figure 16-2 Direction Boards, Source: (<https://www.pmgysy.nic.in/>, n.d.)

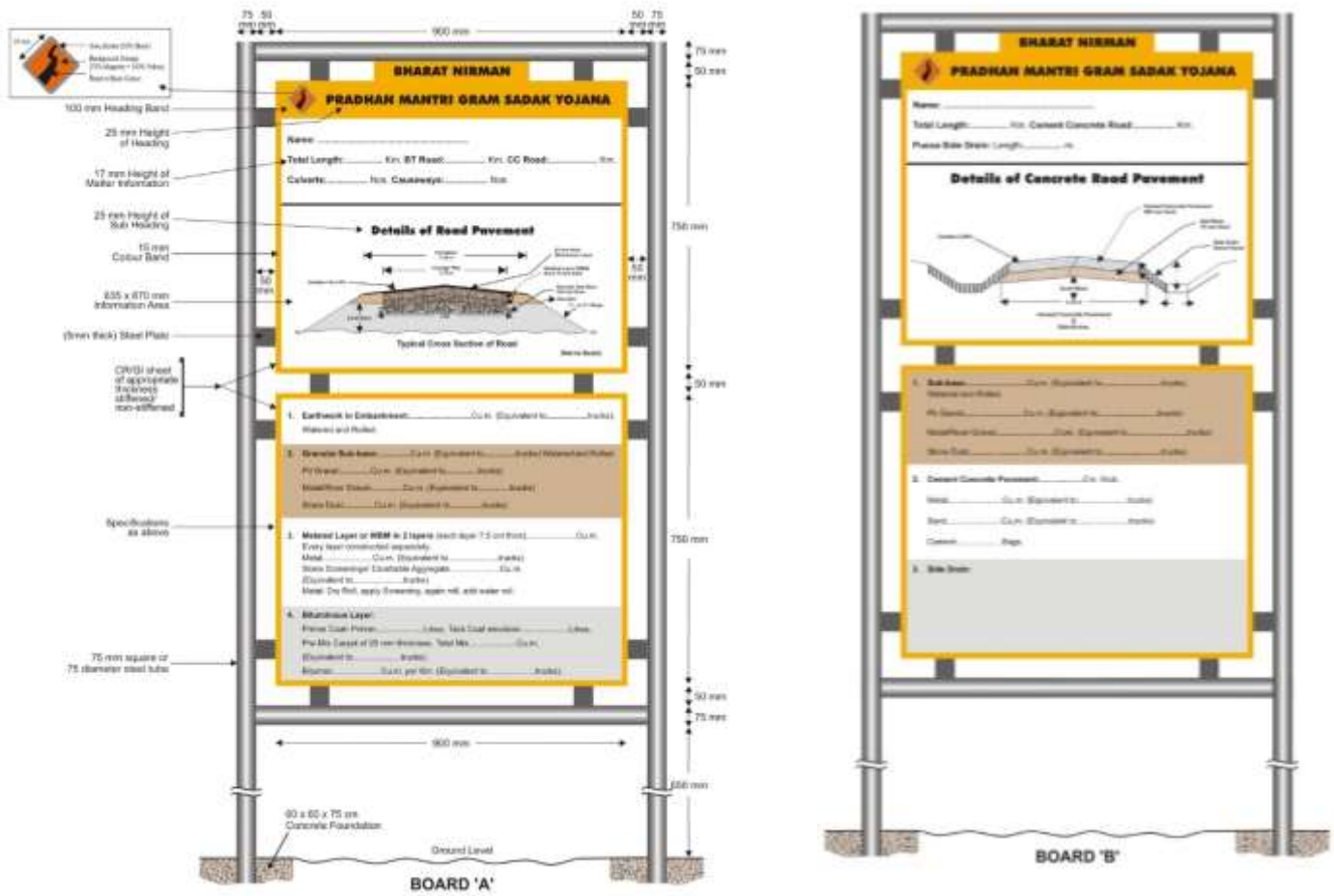


Figure 16-3 Information Board 2 and 3, Source: (<https://www.pmgysy.nic.in/>, n.d.)



3. Cautionary Road Signs

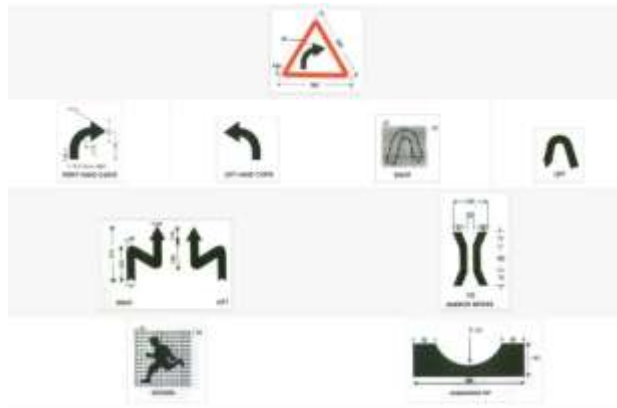


Figure 16-4 Cautionary Signs, Source: (<https://www.pmgysy.nic.in/>, n.d.)

- Road Signs and Direction Boards are to be installed as mentioned above

4. Direction and Place Identification



Figure 16-5 Direction Boards, Source: (<https://www.pmgysy.nic.in/>, n.d.)

5. Type Design for Ordinary Kilometre Stone

- Ordinary Kilometer or 5th Km stones: Fixing as per IRC 18-1980 (as -Applicable for MDRs).
- 1 Km stones as per plate Semicircular portion to be painted in orange colour for both stones.
- Road boundary stones & 0.2 Km stones are also to be fixed:
- Road Boundary stones : Fixing as per IRC publication No 25.
- All stones to be painted in orange colour.
- 0.2 km stones : Fixing as per IRC publication no. 26
- All stones to be painted in white colour.

Typical Road Section for a PMGSY Road:

Typical Cross Section 1

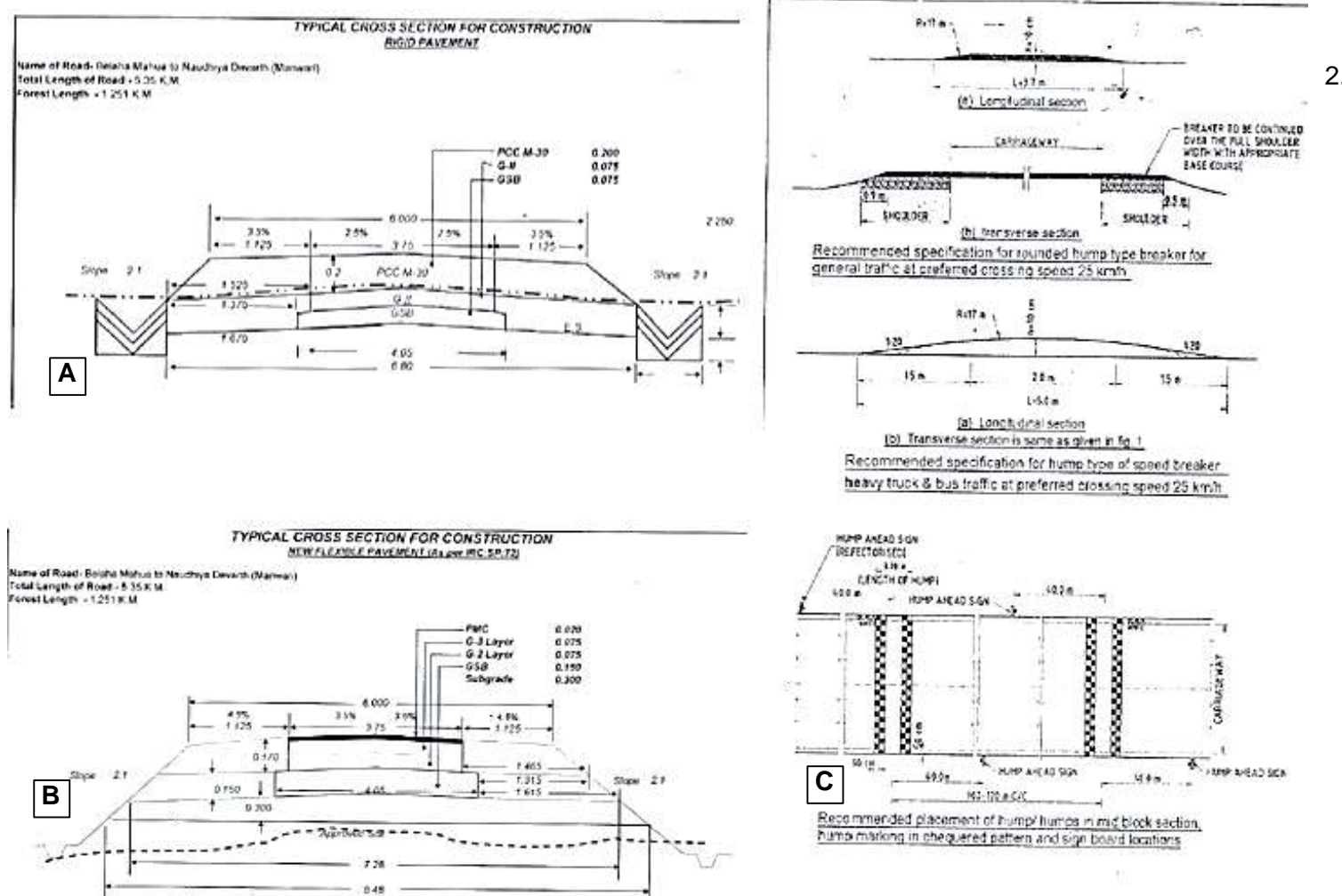


Figure 16-6 A. Cross Section for Rigid Pavement, B. Cross Section for Flexible Pavement, C. Recommended Specification for Humps (Source: Report on a 5.35KM PMGSY Road Constructed in Belaha Mahuva, Siddi, MP)

Typical Cross Section 2

Below is the example of a typical cross section of a road as shown in a report by Sudhir Mathur, Chief Scientist, Central Road Research Institute, New Delhi.

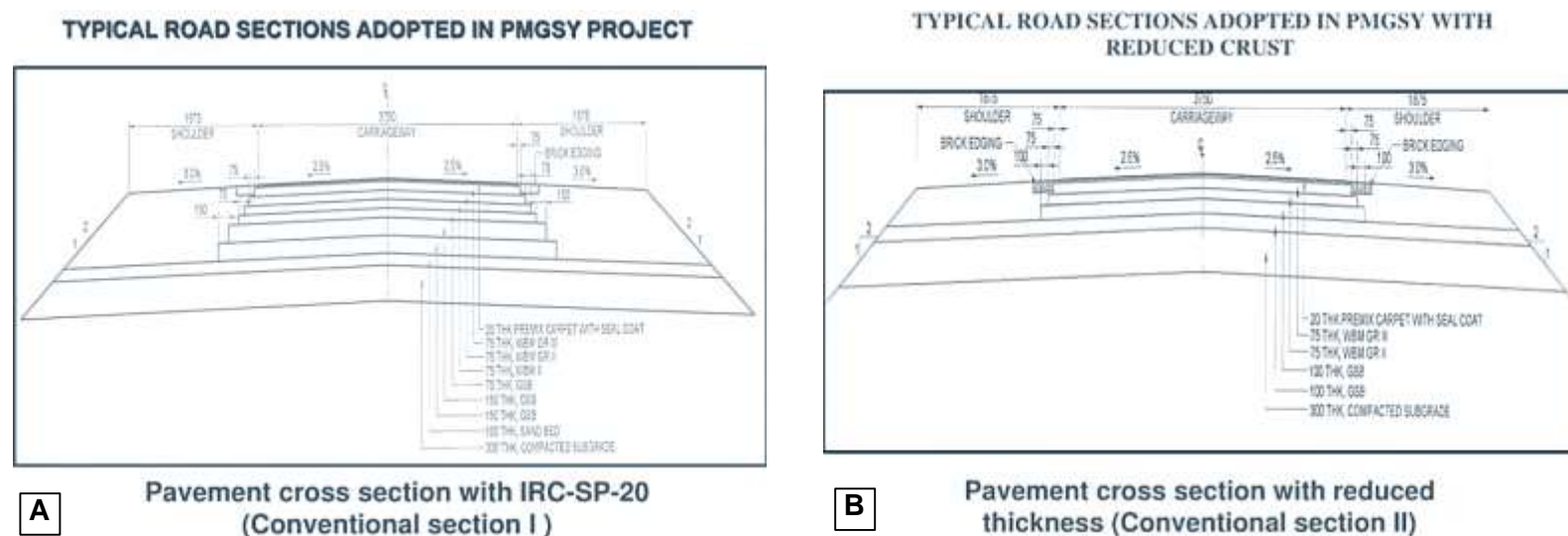


Figure 16-7 A.Section of PMGSY road, B.Typical Section with reduced Crust, Source: Report by Sudhir Mathur, New Delhi

2. Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)

It aims to enhance livelihood security in rural areas by providing at least 100 days of wage employment in a financial year to every household whose adult members volunteer to do unskilled manual work. (Ministry of Rural Development, 2005).

- Strengthening natural resources management through works that address causes of chronic poverty like drought, deforestation and soil erosion and so encourage sustainable development
- Strengthening grassroots processes of democracy
- Infusing transparency and accountability in governance
- Strengthening decentralization and deepening process of democracy by giving a pivotal role to the Panchayati Raj Institutions in planning, monitoring and implementation

2.1 Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)

Key Features of MGNREGA (Source: Dishant James, 2017; *Understanding NREGA: A simple theory and some facts*, Diganta Mukherjee):

- Adult members of a rural household willing to participate, have to apply for registration, either orally or in written, to Gram Panchayat; they will be provided with a Job Card within 15 days after verification, with proper photographs of the members willing, free of cost.
- Employment will be given within 15 days of application for work; if not, daily unemployment allowance as per the Act, has to be paid; liability of payment of unemployment allowance is of the State.
- Work should ordinarily be provided within 5 km radius of the village. In case work is provided beyond 5 km, extra wages of 10% are payable to meet additional transportation and living expenses.
- Wages are to be paid according to the Minimum Wages Act 1948 for agricultural laborers in the State, unless the Centre notifies a wage rate which will not be less than Rs. 60/ per day. Equal wages will be provided to both men and women.
- Disbursement of wages has to be done on weekly basis and not beyond a fortnight in any case.
- At least one-third beneficiaries shall be women who have registered and requested work under the scheme.
- Work site facilities such as crèche, drinking water and shade have to be provided.
- Permissible works predominantly include water and soil conservation, afforestation and land development works. Contractors and machinery are not allowed.
- A 60:40 wage and material ratio has to be maintained.
- The Central Government bears the 100 percent wage cost of unskilled manual labor and 75 percent of the material cost including the wages of skilled and semi skilled workers.

Figure 16-8 Approach to Rural Road planning Block-wise Invalid source specified.

4. Indian Road Congress (IRC: SP:20-2020)

Material:



There are many alternative methods to build roads which can be cost effective and environmentally friendly. Granite and Quartzite are igneous and sedimentary rock respectively, which are found in Karnataka and can be used for building roads. In Karnataka, these types of stones are found easily. Granite is hard, durable resistant to abrasion, coarse grained and quite brittle. They are very good for bituminous courses and WBM. Quartzite on the other hand does not adhere to bitumen but like granite it also hard, durable, and brittle, it is very good and strong material for base course. Various waste materials like fly ash, iron, and steel slag, processed municipal wastes, rice husk ash, marble slurry dust wastes, recycled concrete and quarry waste/mine waste can be used as well. These have been tested and frequently used in field trials (IRC: SP:20-2002).

New materials have also been brought to the fore to utilize in building of roads. Examples are described below:

Geotextiles: Synthetic materials in the form of strong flexible sheets either woven or non-woven and permeable or water tight membranes have been used for several years to improve soil quality and performance in different branches of geotechnical engineering, e.g., lining, drainage and protection of slopes and embankments. Such materials are called geotextile. Natural man-made textiles, such as, jute fabrics, coir mats are also being used extensively in many civil engineering projects and such materials can also be adopted in rural road construction. The geotextiles are generally classified by the manufacturing process, and are often separated into two sub-categories, namely non-woven and woven. Other types of geotextiles include

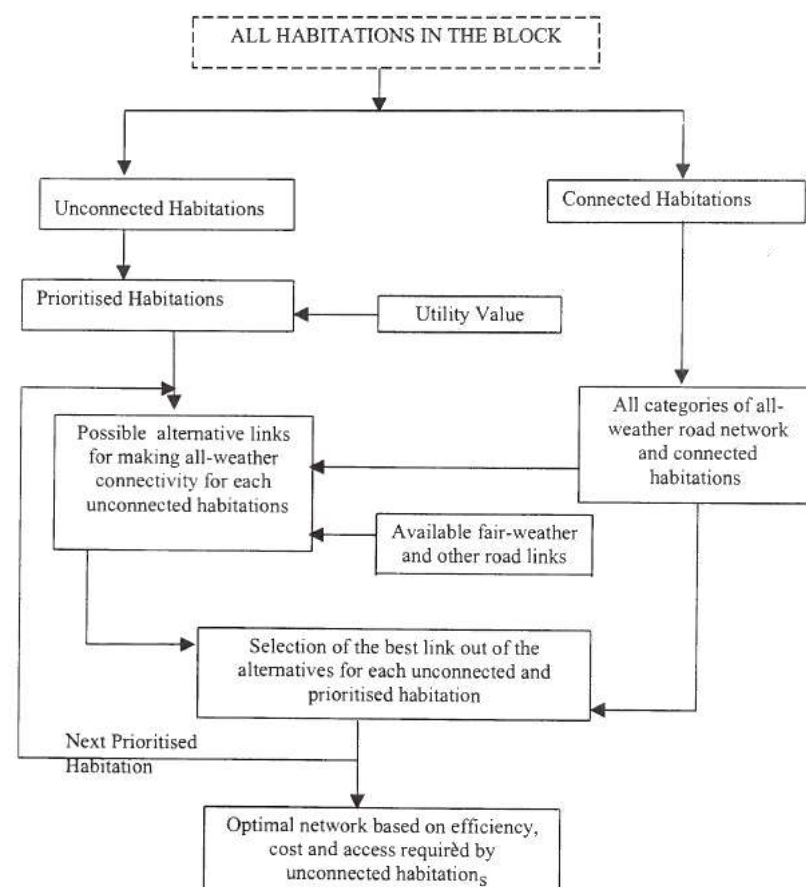
- i. Knitted geotextiles
- ii. Directionally structured filament
- iii. Composite geotextiles.

Natural fibres, like, jute and coir are also used for making Geotextiles. Availability of natural jute in India in abundant quantity gives the natural fiber based fabrics an advantage in terms of cost. Jute is a lignocellulosic natural fiber and as such is biodegradable. There are various application areas where the presence of fabrics is either required for a short duration or where the degradation of fabric does not hinder its application function. In such cases, it is advisable to go for natural materials rather than synthetic materials, as they are available locally and cheap. Fibre drains made up of jute composites are used for consolidation of soft clays. Jute being 100 per cent biodegradable is the only environmentally friendly drain and is acceptable even in the developed countries. These drains are versatile and can be used as:

- i. Vertical drains for consolidation of clays
- ii. Horizontal drains for stabilisation of slopes and
- iii. Horizontal drains to counter the problems arising due to seepage

5. Community Engagement in Rural Road Maintenance:

This is crucial in order to build ownership and sense of responsibility amongst the community about their infrastructural assets. As Transport and Communication Bulletin for Asia and the Pacific, 2011 suggests that the length man system is an effective way in which community can be involved and can earn money as well. In the Length man system – menial tasks are assigned to locals. Any local or labourer can be hired and assigned a particular section of the road which measures 1 to 2 km in length. A supervisor can also be appointed to oversee the work and it can be associated with the Panchayat itself so that making reports, record keeping and road inventory can be done systematically and stored as documents. This system is feasible because it ensures maintenance of roads throughout the year. Countries like Africa



and Bangladesh have already adopted this method. This method could also be set up with a banking system where the labourers can earn their wage and a percentage of that gets deposited into their account so as to help them keep afloat during non-working season or unemployment. The Asian Development Bank says that smaller enterprises can develop quality maintenance work which is low-cost and has better longevity.

(Source: *DEVELOPMENT OF A SUSTAINABLE RURAL ROADS MAINTENANCE SYSTEM IN INDIA: KEY ISSUES*, Ashoke K. Sarkar, *Transport and Communications Bulletin for Asia and the Pacific*, No. 81, 2011)

6. Rural Roads and Sustainable Development Goals:

In a report made by S Vijay Kumar from TERI in 2019 called “Rural Roads and the SDG’s” he states that building rural roads is simple engineering task but it has huge potential to develop a place economically and socially. They help reduce vulnerabilities and provide opportunities for habitations to access other services and amenities required for their survival. Improved roads and infrastructure can help reduce poverty by expanding earnings opportunities through easier access to markets and technology. The poor, like the others may benefit from these changes; but greater commercialization, rising land values, and shifts in growth across local farm and non-farm sectors may also hamper economic opportunities for very poor households, particularly where the initial level of social development is low (Kumar, 2019).

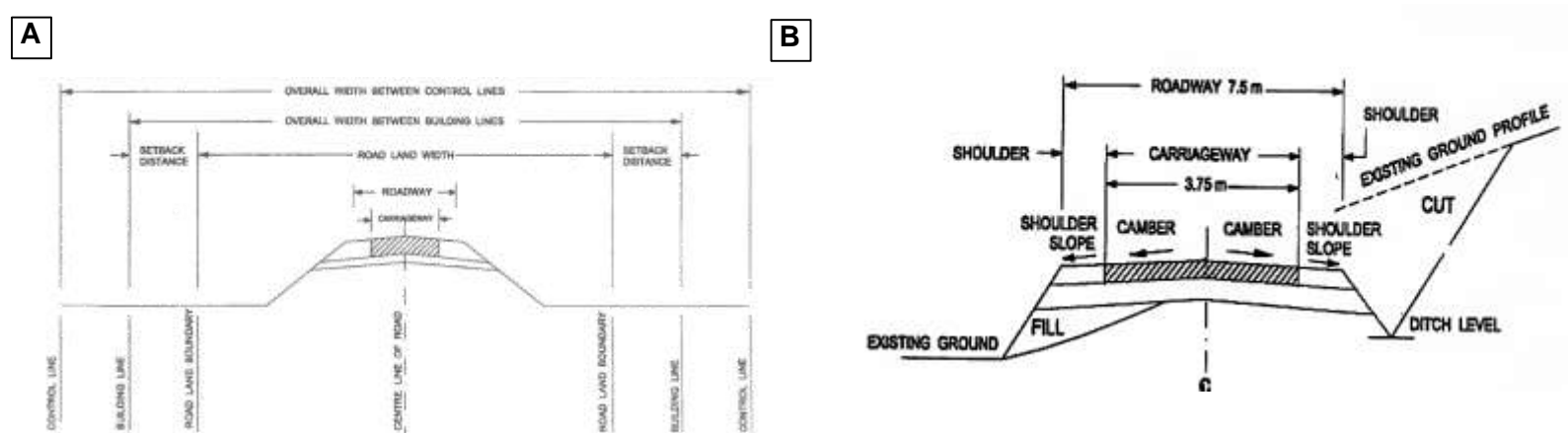


Figure 16-9 (A) Image illustrating the roadway width optimum for rural areas, (B) Image illustrating the carriageway optimum for rural roads, Invalid source specified.

The most optimum way to bring awareness about the importance of road systems for villages is to connect them with the SDG's. In the report the author showed how roads link each of the 17 sustainability goals that will help in bringing a more inclusive development in rural areas. Let us look at these in detail:

- 1. Reduce Poverty in all its forms everywhere:** in this aspects the best practice would be to look at maintenance of road as a strategy to help in sustaining the road for a longer time as opposed to building new roads. This will require community engagement which will empower the people and and they can take care of the road system from connectivity, alignment, and design as well so that transportation is facilitated
- 2. End Hunger achieve food security and improved sustainable agriculture:** In case of Uppunda this goal also becomes very important because rural roads enable agriculture. It helps in movement of the produce and agro-industries. Having this goal will help reduce vehicular operating costs, regularity of services will be ensured and also reduce packaging costs. It will also help in employment generation. All weather road construction is important to foster the economic and social resilience.
- 3. Ensure healthy lives and promote well-being for all at all ages:** with this goal in mind if we design road maintenance in the village then it will help to access primary healthcare and public health institutions as well. It will reduce the travel time during emergencies. Ideally within the village provision of free transport can also be an added benefit.
- 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities:** developing and maintenance of rural roads will also result in better access to better educational facilities. It will help the disadvantaged groups of the society as well like minorities, girls etc.
- 5. Achieve gender equality and empower all women and girls:** this goal can be used to develop the road system as an enabler. This will develop many societal benefits by strengthening the social capital of rural area, access to information and social interaction with other social or self-help groups will be enhanced. It will enable women to opt for higher education as well.
- 6. Ensure availability and sustainable management of water and sanitation for all:** this too is achieved through public engagement. This goal can be utilized to develop a strategy where drinking water supply can be carried to disadvantaged section of society, will help in regular operation and maintenance of the water systems.



7. **Ensure access to affordable, reliable, sustainable and modern energy for all:** Energy supply for cooking presents more challenges than for lighting. The Rajiv Gandhi Grameen LPG Vitaran Yojana (RGGLVY) –and its successor scheme the Pradhan Mantri Ujjwala Yojana (PMUY), aims to increase rural access to LPG through improvement in the supply chain and subsidized LPG for the poor.
8. **Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all:** agriculture sector requires people to be self-employed and due to inadequate road infrastructure it may lead to transportation and accessibility issues. If this goal is taken into consideration, then the habitations can utilize road facility to enhance their income growth from both agriculture and non-agriculture sectors. It will reduce commute time so that way they can work for longer and earn more and freight cost will also reduce
9. **Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation:** rural roads may be susceptible to adverse impacts of transportation, surrounding activities and climate change as well. It is necessary to keep the road connection active specially during any calamities like floods which has high probability of occurring in Uppunda. Hence keeping this goal in mind will help to develop the roads as lifelines that will aid in food, water and medical assistance and help in coping with adversities.
10. **Reduce inequality within and among countries:** Better transport reduces absolute poverty through lowering costs and increasing opportunities, but it may not significantly reduce income disparities and may in fact be increasing it. So this goal needs to be addressed so as to reduce these inequalities which can be done by local resource endowment that can be leveraged for income by using the new road connectivity.
11. **Make cities and human settlements inclusive, safe, resilient and sustainable:** As more rural areas are now connected with all-weather roads and transportation services, overlaid with telecom connectivity, people can stay in a larger village even if it is further away from their agricultural land, and enjoy the benefits of more modern amenities, pucca houses, better transportation options etc. A new sub-scheme named “Aajeevika Grameen Express Yojana (AGEY)” as part of the National Rural Livelihoods Mission (DAY-NRLM) has been started recently. The SHG members are provided concessional finance to operate road transport service in backward areas.
12. **Ensure sustainable consumption and production patterns:** local paths and tracks are usually constructed or get formed in the village using on site materials but good pucca roads require specified materials that are durable in the long run. Responsibly consuming available resources is one of the best practices adopted by states. Roads built in this manner will be sustainable and reduce the supply-demand gap. It will help maintain a regulated circulation, reduce waste and carbon footprint as well.
13. **Take urgent action to combat climate change and its impacts:** rural road construction programme includes Risk and Vulnerability assessment in a more rigorous form than hitherto keeping in view the potential for climate change related impacts. Separately a network-level Risk and Vulnerability assessment must be done in a systematic manner periodically and the outputs incorporated into the renovation, upgradation and maintenance plans.
14. **Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss:** impact assessment is key for this goal to be considered into strategizing the building of roads. Land is limited and hence it is important to adhere to site conditions. Aligning the roads through irrigation intensive areas should be avoided even if it results in longer routes. This will ensure that soil erosion doesn't occur and also it is important that storm water management, ground water percolation, water quality, drainage modification, silting etc. should be mitigated. For the long run, it would be necessary to not only understand the impact of the road in its construction phase, but also in its operations phase. An integrated Social and Environmental Assessment of the sub-network done periodically may be useful to identify areas to be addressed at the time of renovation, upgradation, or maintenance
15. **Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable, and inclusive institutions at all levels:** governance related services such as police, fire services, disaster management, courts and the system of justice, and civil society organisations are an essential part of developing rural roads. The provision for a rural road is only the start of the process that helps reduce poverty. Provision of transport services, facilities and amenities along the alignment (including lighting in the case of some tracks) , ensuring maintenance and road safety are some of the concerns that need to be constantly addressed to optimise on the investment and increase the pro-poor orientation of the infrastructure.

16. Annexure VII – Infrastructure at Uppunda

CATEGORY	NAME	PHOTO	LOCATION (GPS)		WARD NO.	OBSERVATION/ COMMENTS
			Latitude (N)	Longitude (E)		
PHYSICAL INFRASTRUCTURE						
Roads	Bijooru Area		13°50'05.6"	74°37'44.4"	WARD 2	<ul style="list-style-type: none">Approach road_ towards NH 66 high way3-4m wide road, Tar roadNot maintainedNo drains on either sides
	Bijooru Area		13.8275332	74.6237565	WARD 7	<ul style="list-style-type: none">Concrete road, 3-4m wide roadIn good conditionNo storm water drains on either side of the road
	Bijooru Area		13.8280487	74.6263186	WARD 3	<ul style="list-style-type: none">Approach road, 3-4m wide,No proper shoulderNo drains on either sideUnmaintained, smaller pot holes throughout
	Bijooru Area		13.842749	74.6240379	WARD 1	<ul style="list-style-type: none">Approach road near Bijoor, 3-4m wide,No drains on either sideUnmaintained, pot holes throughout the road
	Koderi Area		13° 48'56.62764"	74° 37'15.37932"	WARD 6	<ul style="list-style-type: none">Approach road, 3-4m wide,Concrete roadShoulder has been provided on either sideNo drains on either side
	Prabhu Keri Road		13° 49'6.66444"	74° 37'53.193"	WARD 6	<ul style="list-style-type: none">Mud road road
	Bijooru Area		13° 50'1.8762"	74° 37'1.22304"	WARD 7	<ul style="list-style-type: none">Approach road, 3-4m wide,Concrete roadShoulder has been provided on either sideStorm water drains has been provided on one side
	Bijooru Area		13° 50'1.96368"	74° 37'1.13124"	WARD 7	<ul style="list-style-type: none">Approach road, 3-4m wide,Concrete roadShoulder has been provided on either sideStorm water drains has been provided on both sides
	Bijooru Area		13° 50'4.5618"	74° 37'0.88212"	WARD 8	<ul style="list-style-type: none">Approach road, 3-4m wide,Concrete roadShoulder has been provided on either sideStorm water drain has been provided on one side
Bridges	Edapally-Panvel Highway		13.8480997	74.6307388	WARD 9	<ul style="list-style-type: none">Nagakatte Bridge in Bijoor AreaByndoor River
	Bijoor Area		13°50'27.09196"	74°37'0.59592"	WARD 10	<ul style="list-style-type: none">Small sized bridge around the the Bijoor Area



SOCIAL INFRASTRUCTURE						
Panchayat Office	Near NH 66		13°49'43.7952"	74°37'57.10728"	WARD 3	The main Panchayat office of Uppunda
Bank	Uppunda Shaale Bagilu		13°50'0.84912"	74°37'59.37276"	WARD 3	Pragati Sauhadara Credit Co-operative Socitey
	Bijoor Area		13.8269711°	74.6306626°	WARD 5	Karavali Traditional Fisherman Co-operative Society
Fishery Association	Bijoor Area		13°49'38.40024"	74°37'23.59056"	WARD 8	Rani Bale Meenu Maraata Prathamika Sahakari Sanga Uppunda
College	Bijoor Area		13°49'43.2066"	74°37'57.26892"	WARD 3	Govt. Pre University College, Uppunda
School	Near Uppunda Beach		13°49'37.89588"	74°37'6.19176"	WARD 7	Govt. Higher Primary School
	Near Durgaparameshwari Temple		13°50'59.4636"	74°38'8.23776"	WARD 1	Shri Vivekananda English Medium School
Temple	Near Uppunda Beaach		13°50'5.83728"	74°37'26.94072"	WARD 7	Shri Rama Mandir
	Bijoor Area		13°50'33.02016"	74°37'45.2244"	WARD 1	Shri Durgaparameshwari Temple
	Bijoor Area		13°50'32.45712"	74°37'45.0858"	WARD 1	Najanguda Ragavendra Matha
	Near Vivekananda English Medium School		13°50'5.83728"	74°37'26.94072"	WARD 7	Veera Maruthy Mandira
	Bijoor Area		13°50'26.37816"	74°36'55.64016"	WARD 10	Shri Durgaparameshwari Temple
Mosque	Madikal Area		13.8275332	74.6237565	WARD 7	Mohammadiya Jumma Masjid
Sabha Bhavan	Bijoor Area		13.8348825	74.6289944		Sabha Bhavan • G+1 Community gathering area • Has proper parking space
Fuel Station	Bijoor Area		13°50'35.2464"	74°37'55.36092"	WARD 1	Essar Petroleum Bunk

Gram Panchayat Spatial Development Plan-2020 Uppunda

COMMERCIAL BUILDINGS						
Small Stores	Near NH 66		13°49'38.20296"	74°37'58.44072"	WARD 3	• G+1 commercial building with variety of shops
	Near NH 66		13°49'37.89768"	74°37'58.64484"	WARD 3	• G+1 commercial building with variety of shops
	Near Kasanadi Area		13.827009	74.630581	WARD 3	Ideal Chicken Center Uppunda
	Near Janta Colony		13.8271517	74.6299266	WARD 5	• A small general store
WATER BODY						
Man made Pond	Paduvari Proper		13°50'29.50476"	74°36'59.28516"	WARD 10	A small water body formed in the low elevated area
	Bijoor Area		13°50'17.02204"	74°37'16.29984"	WARD 10	A small water body formed in the low elevated area
Natural Pond	Holikade Pond		13°50'5.83728"	74°37'26.94072"	WARD 8	
River	Prabhu Keri Road		13°49'6.66444"	74°37'53.193"	WARD 6	
	Koderi Area		13°48'54.6084"	74°37'17.96016"	WARD 6	Koderi Harbour Area
	Koderi Area		13°48'53.15148"	74°37'17.88744"	WARD 6	Koderi Harbour Area
	Bijoor Area		13°50'5.83728"	74°37'26.94072"	WARD 6	Karki kali River
	Bijoor Area		13°50'5.83728"	74°37'26.94072"	WARD 9	Riverlet Sumana River
Beach	Koderi Area		13°48'55.35756"	74°37'15.5334"	WARD 6	Uppunda Beach
Storm Water Drain	Bijoor Area		13°50'5.83728"	74°37'26.94072"	WARD 5	Drains filled during rainy season
Drain/canal			13°50'5.81748	74°37'1.9434"	WARD 8	Drain in very bad condition, unlined drains, waste in dumped.



17. Annexure VIII – CRZ Regulations

The key points of the notification are stated herewith:

The Central Government hereby declares the following areas as CRZ and imposes with effect from the date of the notification the following restrictions on the setting up and expansion of industries, operations or processes and the like in the CRZ,-

- (i) The land area from High Tide Line (hereinafter referred to as the HTL) to 500mts on the landward side along the sea front.
- (ii) CRZ shall apply to the land area between HTL to 100 mts or width of the creek whichever is less on the landward side along the tidal influenced water bodies that are connected to the sea and the distance up to which development along such tidal influenced water bodies is to be regulated shall be governed by the distance upto which the tidal effects are experienced which shall be determined based on salinity concentration of 5 parts per thousand (ppt) measured during the driest period of the year and distance upto which tidal effects are experienced shall be clearly identified and demarcated accordingly in the Coastal Zone Management Plans (hereinafter referred to as the CZMPs).
Explanation - For the purposes of this sub-paragraph the expression tidal influenced water bodies means the water bodies influenced by tidal effects from sea, in the bays, estuaries, rivers, creeks, backwaters, lagoons, ponds connected to the sea or creeks and the like.
- (iii) The land area falling between the hazard line and 500mts from HTL on the landward side, in case of seafront and between the hazard line and 100mts line in case of tidal influenced water body the word 'hazard line' denotes the line demarcated by Ministry of Environment and Forests (hereinafter referred to as the MoEF) through the Survey of India (hereinafter referred to as the Sol) taking into account tides, waves, sea level rise and shoreline changes.
- (iv) Land area between HTL and Low Tide Line (hereinafter referred to as the LTL) which will be termed as the intertidal zone.
- (v) The water and the bed area between the LTL to the territorial water limit (12 Nm) in case of sea and the water and the bed area between LTL at the bank to the LTL on the opposite side of the bank, of tidal influenced water bodies. For the purposes of this notification, the HTL means the line on the land upto which the highest water line reaches during the spring tide and shall be demarcated uniformly in all parts of the country by the demarcating authority(s) so authorized by the MoEF in accordance with the general guidelines issued at Annexure-I. HTL shall be demarcated within one year from the date of issue of this notification.

Prohibited activities within CRZ,-

The following are declared as prohibited activities within the CRZ,-

- (i) Setting up of new industries and expansion of existing industries except,-
 - (a) Those directly related to waterfront or directly needing foreshore facilities;
Explanation: The expression "foreshore facilities" means those activities permissible under this notification and they require waterfront for their operations such as ports and harbours, jetties, quays, wharves, erosion control measures, breakwaters, pipelines, lighthouses, navigational safety facilities, coastal police stations and the like.;
 - (b) Projects of Department of Atomic Energy;
 - (e) Reconstruction, repair works of dwelling units of local communities including fishers in accordance with local town and country planning regulations.
- (ii) Manufacture or handling oil storage or disposal of hazardous substance as specified in the notification of Ministry of Environment and Forests, No. S.O.594 (E), dated the 28th July 1989, S.O.No.966 (E), dated the 27th November, 1989 and GSR 1037 (E), dated the 5th December, 1989 except,-
 - (a) Transfer of hazardous substances from ships to ports, terminals and refineries and vice versa;
 - (b) Facilities for receipt and storage of petroleum products and liquefied natural gas as specified in Annexure-II appended to this notification and facilities for regasification of Liquefied Natural Gas (hereinafter referred to as the LNG) in the areas not classified as CRZ- I(i) subject to implementation of safety regulations including guidelines issued by the Oil Industry Safety Directorate in the Ministry of Petroleum and Natural Gas and guidelines issued by MoEF and subject to further terms and conditions for implementation of ameliorative and restorative measures in relation to environment as may be stipulated by in MoEF.

Provided that facilities for receipt and storage of fertilizers and raw materials required for manufacture of fertilizers like ammonia, phosphoric acid, sulphur, sulphuric acid, nitric acid and the like, shall be permitted within the said zone in the areas not classified as CRZ-I (i).

(iii) Setting up and expansion of fish processing units including warehousing except hatchery and natural fish drying in permitted areas:

(iv) Land reclamation, bunding or disturbing the natural course of seawater except those,-

(a) Required for setting up, construction or modernization or expansion of foreshore facilities like ports, harbours, jetties, wharves, quays, slipways, bridges, sealink, road on stilts, and such as meant for defence and security purpose and for other facilities that are essential for activities permissible under the notification;

(b) Measures for control of erosion, based on scientific including Environmental Impact Assessment (hereinafter referred to as the EIA) studies

(c) Maintenance or clearing of waterways, channels and ports, based on EIA studies;

(d) Measures to prevent sand bars, installation of tidal regulators, laying of storm water drains or for structures for prevention of salinity ingress and freshwater recharge based on carried out by any agency to be specified by MoEF.

(v) Setting up and expansion of units or mechanism for disposal of wastes and effluents except facilities required for,-

(a) Discharging treated effluents into the water course with approval under the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974);

(b) Storm water drains and ancillary structures for pumping;

(c) Treatment of waste and effluents arising from hotels, beach resorts and human settlements located in CRZ areas other than CRZ-I and disposal of treated wastes and effluents;

(vi) Discharge of untreated waste and effluents from industries, cities or towns and other human settlements. The concerned authorities 'shall implement schemes for phasing out existing discharge of this nature, if any, within a time period not exceeding two years from the date of issue of this notification.

(vii) Dumping of city or town wastes including construction debris, industrial solid wastes, flyash for the purpose of land filling and the like and the concerned authority shall implement schemes for phasing out any existing practice, if any, shall be phased out within a period of one year from date of commencement of this notification.

Note:-The MoEF will issue a separate instruction to the State Governments and Union territory

Administration in respect of preparation of Action Plans and their implementation as also monitoring including the time schedule thereof, in respect of paras (v), (vi) and (vii).

(viii) Port and harbours projects in high eroding stretches of the coast, except those projects classified as strategic and defence related in terms of EIA notification, 2006 identified by MoEF based on scientific studies and in consultation with the State Government or the Union territory Administration.

(ix) Reclamation for commercial purposes such as shopping and housing complexes, hotels and entertainment activities.

(x) Mining of sand, rocks and other sub-strata materials except,-

(a) Those rare minerals not available outside the CRZ area,

(b) Exploration and exploitation of Oil and Natural Gas.

(xi) Drawl of groundwater and construction related thereto, within 200mts of HTL; except the following:-

(a) In the areas which are inhabited by the local communities and only for their use.

(b) In the area between 200mts-500mts zone the drawl of groundwater shall be permitted only when done manually through ordinary wells for drinking, horticulture, agriculture and fisheries and where no other source of water is available.

Note:-Restrictions for such drawl may be imposed by the Authority designated by the State Government and Union territory Administration in the areas affected by sea water intrusion.

(xi) Construction activities in CRZ-I except those specified in para 8 of this notification.

(xiii) Dressing or altering the sand dunes, hills, natural features including landscape changes for beautification, recreation and other such purpose.

(xiv) Facilities required for patrolling and vigilance activities of marine/coastal police stations.

4. Regulation of permissible activities in CRZ area.

The following activities shall be regulated except those prohibited in para 3 above, -

(i)(a) Clearance shall be given for any activity within the CRZ only if it requires waterfront and foreshore facilities;

(b) For those projects which are listed under this notification and also attract EIA notification, 2006 (S.O.1533 (E), dated the 14th September, 2006), for such projects clearance under



EIA notification only shall be required subject to being recommended by the concerned State or Union territory Coastal Zone Management Authority (hereinafter referred to as the CZMA).

- (c) Housing schemes in CRZ as specified in paragraph 8 of this notification;
- (d) Construction involving more than 20,000sq mts built-up area in CRZ-II shall be considered in accordance with EIA notification, 2006 and in case of projects less than 20,000sq mts built-up area shall be approved by the concerned State or Union territory Planning authorities in accordance with this notification after obtaining recommendations from the concerned CZMA and prior recommendations of the concern CZMA shall be essential for considering the grant of environmental clearance under EIA notification, 2006 or grant of approval by the relevant planning authority.
- (e) MoEF may under a specific or general order specify projects which require prior public hearing of project affected people.
- (f) Construction and operation for ports and harbours, jetties, wharves, quays, slipways, ship construction yards, breakwaters, groynes, erosion control measures;
- (ii) The following activities shall require clearance from MoEF, namely: -
 - (a) Those activities not listed in the EIA notification, 2006.
 - (b) Construction activities relating to projects of Department of Atomic Energy or Defence requirements for which foreshore facilities are essential such as, slipways, jetties, wharves, quays; except for classified operational component of defence projects. Residential buildings, office buildings, hospital complexes, workshops of strategic and defence projects in terms of EIA notification, 2006;
 - (c) Construction, operation of lighthouses;
 - (d) Laying of pipelines, conveying systems, transmission line;
 - (e) Exploration and extraction of oil and natural gas and all associated activities and facilities thereto;
 - (f) Foreshore requiring facilities for transport of raw materials, facilities for intake of cooling water and outfall for discharge of treated wastewater or cooling water from thermal power plants. MoEF may specify for category of projects such as at (f), (g) and (h) of para 4;
 - (g) Mining of rare minerals as listed by the Department of Atomic Energy;
 - (h) Facilities for generating power by non-conventional energy resources, desalination plants and weather radars;
 - (i) Demolition and reconstruction of (a) buildings of archaeological and historical importance, (ii) heritage buildings; and buildings under public use which means buildings such as for the purposes of worship, education, medical care and cultural activities;

4.2 Procedure for clearance of permissible activities. -

All projects attracting this notification shall be considered for CRZ clearance as per the following procedure, namely: -

- (i) The project proponents shall apply with the following documents seeking prior clearance under CRZ notification to the concerned State or the Union territory Coastal Zone Management Authority,-
 - (a) Form-1 (Annexure-IV of the notification);
 - (b) Rapid EIA Report including marine and terrestrial component except for construction projects listed under 4(c) and (d)
 - (c) Comprehensive EIA with cumulative studies for projects in the stretches classified as low and medium eroding by MoEF based on scientific studies and in consultation with the State Governments and Union territory Administration;
 - (d) Disaster Management Report, Risk Assessment Report and Management Plan;
 - (e) CRZ map indicating HTL and LTL demarcated by one of the authorized agency (as indicated in para 2) i n 1:4000 scale;
 - (f) Project layout superimposed on the above map indicated at (e) above;
 - (g) The CRZ map normally covering 7km radius around the project site.
 - (h) The CRZ map indicating the CRZ-I, II, III and IV areas including other notified ecologically sensitive areas;
 - (i) No Objection Certificate from the concerned State Pollution Control Boards or Union territory Pollution Control Committees for the projects involving discharge of effluents, solid wastes, sewage and the like.;

- (ii) The concerned CZMA shall examine the above documents in accordance with the approved CZMP and in compliance with CRZ notification and make recommendations within a period of sixty days from date of receipt of complete application,-
 - (a) MoEF or State Environmental Impact Assessment Authority (hereinafter referred to as the SEIAA) as the case may be for the project attracting EIA notification, 2006;
 - (b) MoEF for the projects not covered in the EIA notification, 2006 but attracting para 4(ii) of the CRZ notification;
 - (iii) MoEF or S E I A A shall consider such projects for clearance based on the recommendations of the concerned CZMA within a period of sixty days.
- (vi) The clearance accorded to the projects under the CRZ notification shall be valid for the period of five years from the date of issue of the clearance for commencement of construction and operation.
- (v) F o r Post clearance monitoring – (a) it shall be mandatory for the project proponent to submit half-yearly compliance reports in respect of the stipulated terms and conditions of the environmental clearance in hard and soft copies to the regulatory authority(s) concerned, on 1st June and 31st December of each calendar year and all such compliance reports submitted by the project p r o p o n e n t shall be published in public domain and its copies shall be given to any person on application to the concerned CZMA.
- (b) The compliance report shall also be displayed on the website of the concerned regulatory authority.
- (vi) To maintain transparency in the working of the CZMAs it shall be the responsibility of the CZMA to create a dedicated website and post the agenda, minutes, decisions taken, clearance letters, violations, action taken on the violations and court matters including the Orders of the Hon'ble Court as also the approved CZMPs of the respective State Government or Union territory.

7. Classification of the CRZ – For the purpose of conserving and protecting the coastal areas and marine waters, the CRZ area shall be classified as follows, namely:-

(iii) CRZ-III,-

Areas that are relatively undisturbed and those do not belong to either CRZ-I or II which include coastal zone in the rural areas (developed and undeveloped) and also areas within municipal limits or in other legally designated urban areas, which are not substantially built up.

8. Norms for regulation of activities permissible under this notification,-

(i) The development or construction activities in different categories of CRZ shall be regulated by the concerned CZMA in accordance with the following norms, namely:-

Note: - The word existing use hereinafter in relation to existence of various features or existence of regularisation or norms shall mean existence of these features or regularisation or norms as on 19.2.1991 wherein CRZ notification, was notified.

III. CRZ-III,-

Area upto 200mts from HTL on the landward side in case of seafront and 100mts along tidal influenced water bodies or width of the creek whichever is less is to be earmarked as “No Development Zone (NDZ)”,-

- (i) The NDZ shall not be applicable in such area falling within any notified port limits;
- (ii) No construction shall be permitted within NDZ except for repairs or reconstruction of existing authorized structure not exceeding existing Floor Space Index, existing plinth area and existing density and for permissible activities under the notification including facilities essential for activities; Construction/reconstruction of dwelling units of traditional coastal communities including fisherfolk may be permitted between 100 and 200 metres from the HTL along the seafront in accordance with a comprehensive plan prepared by the State Government or the Union territory in consultation with the traditional coastal communities including fisherfolk and incorporating the necessary disaster management provision, sanitation and recommended by the concerned State or the Union territory CZMA to NCZMA for approval by MoEF;
- (iii) However, the following activities may be permitted in NDZ –
 - (a) Agriculture, horticulture, gardens, pasture, parks, play field, and forestry;
 - (b) Projects relating to Department of Atomic Energy;
 - (c) Mining of rare minerals;
 - (d) Salt manufacture from seawater;
 - (e) Facilities for receipt and storage of petroleum products and liquefied natural gas as specified in Annexure-II;



- (f) Facilities for regasification of liquefied natural gas subject to conditions as mentioned in subparagraph (ii) of paragraph 3;
- (g) Facilities for generating power by non-conventional energy sources;
- (h) Foreshore facilities for desalination plants and associated facilities;
- (i) Weather radars;
- (j) Construction of dispensaries, schools, public rain shelter, community toilets, bridges, roads, provision of facilities for water supply, drainage, sewerage, crematoria, cemeteries and electric sub-station which are required for the local inhabitants may be permitted on a case to case basis by CZMA;
- (k) Construction of units or auxiliary thereto for domestic sewage, treatment and disposal with the prior approval of the concerned Pollution Control Board or Committee;
- (l) Facilities required for local fishing communities such as fish drying yards, auction halls, net mending yards, traditional boat building yards, ice plant, ice crushing units, fish curing facilities and the like;
- (m) Development of green field airport already permitted only at Navi Mumbai.

Area between 200mts to 500mts,-

The following activities shall be permissible in the above areas;

- (i) Development of vacant plot in designated areas for construction of hotels or beach resorts for tourists or visitors subject to the conditions as specified in the guidelines at Annexure-III;
- (ii) Facilities for receipt and storage of petroleum products and liquefied natural gas as specified in Annexure-II;
- (iii) Facilities for regasification of liquefied natural gas subject to conditions as mentioned in sub-paragraph (ii) of paragraph 3;
- (iv) Storage of non-hazardous cargo such as, edible oil, fertilizers, food grain in notified ports;
- (v) Foreshore facilities for desalination plants and associated facilities;
- (vi) Facilities for generating power by non-conventional energy sources;
- (vii) Construction or reconstruction of dwelling units so long it is within the ambit of traditional rights and customary uses such as existing fishing villages and goathans.
Building permission for such construction or reconstruction will be subject to local town and country planning rules with overall height of construction not exceeding 9mts with two floors (ground + one floor);
- (viii) Construction of public rain shelters, community toilets, water supply drainage, sewerage, roads and bridges by CZMA who may also permit construction of schools and dispensaries for local inhabitants of the area for those panchayats, the major part of which falls within CRZ if no other area is available for construction of such facilities;
- (ix) Reconstruction or alteration of existing authorised building subject to sub-paragraph (vii), (viii);
- (x) Development of green field airport already permitted only at Navi Mumbai.

18. Annexure IX – Action Plan Recommended for Safeguarding of Biodiversity

Establishment of seabird conservation sites

important habitats for seabirds, are reportedly being affected by naval exercises. The State Government along with the Defense authorities should protect the seabirds and other characteristic island ecosystems of Karnataka coast.

Establishment of protected areas for threatened estuarine fishes

To rehabilitate important threatened fishes such as Milkfish -*Chanos chanos* and Kanae meenu – *Silage sahama*, captive breeding may be carried out in the Kodi fish farm near Coondapur and the fingerlings produced may be released in the estuaries.

Promoting sustainable utilization of marine/estuarine fish

Strict implementation of uniform “closed season” for marine fishing for the entire west coast, from 10 June to 15 August is expected to protect the brood stock of fishes from exploitation by the mechanized sector. Mesh regulations of nets necessary to exclude juveniles and non-target species. Licenses for additions to the fleet of purse-seines and trawlers should be limited to sustainable limits. Soft loans for fisheries sector be limited to traditional fishing communities only so as to safeguard the fish stocks from over-exploitation by outside commercial sector. No collaborative ventures for the bottom trawling, very destructive to marine ecosystems, be permitted in Indian territorial waters.

Use of large trawl nets to be regulated to minimize incidental catches and other damages to the sea bottom ecosystems.

Priority steps to be taken to identify fish breeding grounds and other sensitive areas and such areas be declared as “Marine Protected Areas”. CRZ regulations do state fish breeding areas to be treated as CRZ I. In practice no such areas are identified. Periodical ban on catch and sale of over-exploited fish species to be implemented

Safeguarding the livelihood security of artisanal fisherfolks

The near-shore waters, to a specified distance, to be reserved for fishing by artisan fishermen only who use traditional crafts and gear. The coast guard may be deployed to safeguard the interests of the artisan fishermen. Promotion of self-help groups and co-operatives among fisher-women required.

Pollution control in the prawn farms

The Supreme Court norms for shrimp farmers need to be adhered to strictly. The stocking levels in the shrimp farms to be monitored and certified periodically. The shrimps to be grown only by using biodegradable manures and disinfectants.

Protection of ecology of sea shores

Many sea beaches of the coast are vulnerable to erosion during the rainy season; but building of protective stone walls along such beaches destroys beach ecology. Priority to be given for protection of beaches by raising vegetation and sand dunes. Raising economically important plants such as Honne (*Calophyllum inophyllum*), Honge (*Pongamia pinnata*), Ketike

(*Pandanus*) and medicinal plants etc. can strengthen livelihoods of coastal poor. The natural beauty of the sea beaches will be enhanced through raising vegetation, and such beaches can promote tourism. Beach vegetation also enhances ecosystem value such as shelter for coastal birds, enrichment of inter-tidal fauna, and nutrient supply to the coastal waters, in addition to building up of sand dunes and promotion of ground water conservation

Turtle breeding areas along the Gangoli (Coondapur taluk) and Karwar taluk beaches need to be safeguarded from human disturbances. Night camping by tourists in such areas need to be prohibited. However ecological conservation works and nature club activities may be promoted.

Promotion of eco-tourism in beaches

The development of eco-tourism and protection of ecology have to go hand in hand. Ecotourism development should benefit local villagers and improve the ecology of beaches. The activities necessary for promotion of ecotourism are: Beautification of beaches by raising natural vegetation.

Promotion of sand dunes.

Cleaning of plastic trash.

Assistance to the local bodies for appointment of beach maintenance staff (from local villagers).

Tourism Department may provide assistance for eco-tourism.

Mangrove planting and protection

Mangrove swamps are high ranking productive ecosystems. Mangrove areas are rich in fisheries and act as nurseries for juveniles of fish, prawns, shellfish and crabs. The mangroves shelter coastal water birds and enrich the waters with nutrients. Mangroves can protect coastal river banks from erosion, rivers from flooding as well as compensate for the loss of nutrient input into the Western Ghats forests, due to the construction of dams. Yet they have suffered large-scale destruction due to human activities. Coastal panchayats be allowed funds for mangrove planting. Incentives to be given



to village Self-Help Groups and other village level organizations for raising and maintaining mangrove forests. Traditional fishermen of backwater villages, whose livelihoods have been affected by commercial shrimp farming, may be also used for mangrove regeneration projects. Forest Department to play important role in raising mangrove vegetation. Abandoned prawn farms may be planted with mangroves so that their ecology is restored and they are made suitable for natural method of fish farming and raising of salt tolerant rice.

VIII. Establishment of lake/tank/reservoir centered biodiversity conservation

Threatened endemic fishes of the tanks of Karnataka, especially belonging to the genera such as *Labeo*, *Puntius*, *Gonoproktopterus*, *Mystus*, *Neotropius*, *Channa* etc. need to be multiplied in suitable fish farms. The fish seed from these farms may be released in other areas. Twenty tanks are proposed to be developed for in situ conservation of fishes.

Since the African catfish (*Clarias gariepinus*) being cultured in the lakes around the cities of Karnataka poses danger to the native fish species, the culturing of this species is to be strictly regulated. Catchment areas of tanks need to be re-vegetated using NTFP species such as medicinal plants. The Inland Fisheries Act for the conservation of fisheries in the State is proposed to be brought before the Legislature shall have proper power to regulate fisheries activities.